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QUANTITATIVE SITUATIONAL ANALYSIS

A Planning Tool for Water Resource Managers

by

H. Johnson Nicholson
C. H. Castore

March 1979

PURDUE UNIVERSITY
WATER RESOURCES RESEARCH CENTER
WEST LAFAYETTE, INDIANA

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16. Abstract

A planning methodology is developed which provides for the water resource managers and decision makers a procedure for structuring and quantifying public input into water resources management decisions. The method referred to as Quantitative Situational Analysis provides an opportunity to assess and predict the response of public officials, intensely interested groups, and the general public to a technology innovation which may be of a controversial nature. The procedure is especially adapted to those decisions involving low risk - high consequence technology.

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A Planning Tool for Water
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Prepared by
Heather Johnston Nicholson and Carl H. Castore

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(Respectfully submitted,)

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QUANTITATIVE SITUATIONAL ANALYSIS

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QUANTITATIVE SITUATIONAL ANALYSIS: A PLANNING TOOL FOR WATER RESOURCE MANAGERS

Prepared by Heather Johnston Nicholson and
Carl H. Castore

The purpose of this report is: (1) To provide an indication of the advantages to a water resource manager of using what we have called a Quantitative Situational Analysis as a basic project planning tool. And (2) to provide the water resource manager with a straightforward method of structuring and quantifying public input into water resource management decisions. Before proceeding, the special problem of low risk-high consequence technology is placed in theoretical perspective.

Introduction: Low Risk-High Consequence Technology and the Water Resource Manager

Water resource managers today must make decisions about large scale technological projects. Programs for energy provision, pesticide control, transportation, urban development, environmental management, and others are large-scale technological projects having wide impact on different segments of society. The decisions and impacts are variously international, national, regional, and local in scope. Such projects are technological in that there are intricate technical details to be resolved involving the uses of land, labor, materials, and machines. These projects have broad social consequences as many different groups in society are affected by the actions taken.

Several key problems involved with such projects are: (1) there exist multiple, conflicting objectives; (2) there exist significant uncertainties about unknown future events, preferences, and alternatives; and (3) there exist diverse groups whose legitimate interests are often antagonistic and unknown to each other. As a result, long-range planning is very difficult. The evaluation of alternatives for decision making on such projects must, realistically, be viewed as an extraordinarily complex process and equally as much a socio-political problem as a techno-economic problem.

Compounding the difficulties is that in the past, such projects were almost completely entrusted to the professional. The professionals defined the problem, proposed, analyzed, and evaluated the alternatives, and recommended a course of action which was generally accepted by some higher authority. Questions are now being raised concerning this traditional approach to decision making. Large segments of the public no longer wish to entrust such decisions completely to the professional. Demands are being made for increased communication among government, industry, and the citizenry. The technically trained professional can no longer operate in a vacuum, making decisions about large-scale technological projects in an abstract, presumably "objective" way. Thus, such "objective" techniques as cost benefit analysis can no longer be accepted as the principal basis for decisions about large-scale technological projects.

Instead of cost benefit analysis, what is needed are techniques for evaluating alternative systems, which (1) explicitly identify which groups are benefited and which groups are harmed by each alternative system, and to what extent each is affected; (2) can deal with impacts which are difficult to quantify; and (3) promote effective, constructive interaction between the technical team (analysts, experts, decision makers), and groups potentially affected.

Social Choice

In the broadest sense, decisions about large-scale innovation cannot be solved objectively. There is no, and can be no, non-subjective means of defining what is best for society.

The comprehensive model of decision-making assumes that individual preferences are at least in principle knowable, known and transitive. (Chipman, 1960, 1971; Encarnacion, 1964; Fishburn, 1974). That is, through the use of decision rules, specifying majority rule as fifty percent plus one, decisions can be made. However, there are a number of problems with applying this conception of social choice to the "real world." Political scientists' understanding of voting behavior is highly developed. Through the use of multivariate techniques and computer simulation they have reached a high degree of accuracy in prediction. Much of the improved power of these techniques has come from altering or abandoning assumptions that every citizen votes, that every citizen has a "complete set" of policy preferences and that policy preferences are uni-dimensionally transitive. (Campbell, A., et al, 1960, 1966; Key, 1966; Pool, et al, 1964; Shaffer, 1972). In short, the political scientist's understanding of citizen policy preferences departs substantially from the comprehensive decision-theorist's assumptions. (Bauer and Gergen, 1968; Thompson, 1971).

A second problem is that citizen preference is only the first step in a complex process of decision making. The relationship between societal preferences (even assuming they are knowable and known) and decisions made in political institutions is anything but automatically isomorphic. Binding decisions are made in myriad institutions, public and private. Identifying the decision makers (individuals, groups, institutions) is at least as problematic as determining how a decision is reached.

The American political process is described as decentralized, specialized, pluralist and incremental. In a purely descriptive sense, incremental decision theory is more "accurate" than comprehensive theory in accounting for social choice in the United States. Comparative analysis of policy-making in the American states suggests strongly that choice is marginal; the best predictor of a state's expenditures by policy area is its own previous expenditures. (Sharkansky, 1969, 1970; Jacob and Vines, 1971). The same phenomenon has been copiously documented at the national level (Wildavsky, 1964; Key, 1964; Truman, 1951). Incremental, more nearly than comprehensive theory, then, approximates empirical understanding of governmental decision making.

A third problem is that decision theory, to the extent it is formal rather than substantive, may have serious shortcomings. Legislatures and executive agencies, no less than other segments of society, have vested interests (Jones, 1961, 1970; Fenno, 1966; Johnston, 1972). The statement, "Let the legislature decide those issues which are clearly problems of public goal-ordering," often assumes with astounding naiveté that the legislature will act collectively, disinterestedly, independently and publicly. Case studies of legislative and bureaucratic decision-making show again and again the importance of subject matter expertise in the (1) relative influence and (2) value commitment of decision makers. In addition, the relative influence of groups may change from issue to issue.

A fourth point is that decisions about large scale technology systems are most likely to be negotiated, either privately among planners and particular interests, or publicly through a more overt political bargaining process (Cassidy, et al, 1973). In arriving at a negotiated agreement, however, we must be careful not to assume that the choice problem necessarily has a rational solution. That is, we must not expect that the result of a negotiation process or any multiperson game will necessarily meet a single rationally objective criterion. Examples abound of situations where the preferences of the different groups involved are so much in conflict that no mutually acceptable solution exists and in which, consequently, the outcome will be determined arbitrarily or by chance. Further, it can be shown that objectively rational behavior, which could be inferred logically by analysis, in fact can be collectively disastrous (Howard, 1971).

Role of Decision Analysis

Even if there does not exist an objective means to describe a situation of choice, it is important to understand what the preferences and risk perceptions of the various groups are before making decisions on large scale technological projects. For example, if citizen values and risk perceptions are known, these can be used by system designers to define relevant alternatives and specify "policy spaces" which are mutually acceptable to user, developer, and planner--thus reducing the waste of scarce resources.

Because the technological systems we are concerned with inevitably involve multiple conflicting objectives, uncertainties about future events with high consequences, non-stationary environments, and long range planning horizons, the determination of preferences for any individual or interest group is complex. It is in precisely such situations that a systematic analysis can be most useful.

Among the effective techniques for eliciting preferences are those associated with decision analysis. Given the cooperation of a party to a decision, either an individual or a homogeneous interest group, the analysis permits them to sort out the complex issues and to provide them with a systematic ranking of their alternatives which are consistent with their real preferences. This process can be very useful for the persons for whom it is done and for the planners and designers themselves. It is certainly preferable to the alternatives: no analysis or some haphazard approach.

The use of the techniques of decision analysis does not, however, lead directly to a decision unless the party for whom the analysis is done is, in fact, the decision maker and has the power to act according to his preferences. This is not generally the situation in public large scale technological projects: it is a fundamental proposition of political science that titular decision makers, executives in charge of a program for example, generally can only choose among a very limited set of alternatives which have been mostly defined by others. Alternatives are often developed for them and choices must be made.

The contribution of the decision analytic approach is, rather, to define important issues and establish a logical, consistent framework for analysis by parties interested in the problem.

Technological Development

Technological development can be viewed in at least two ways. The traditional view is that technological innovation is a purposive search for better ways of doing things. Sophisticated methods of testing the purity of drinking water and massive dams to produce hydroelectricity and water for irrigation are examples of large development projects designed to improve public welfare.

The question has been not so much, Are all the consequences of this technology positive?, as Are the obvious benefits of this technology warranted in the immediate instance by the economic costs? American commitment to technological innovation as a positive means of achieving social goals is evidenced by continued governmental investment in research and development. In this positive view of technological development, one task of the administrator is to keep abreast of technological innovation in order to propose and implement improvements.

Another way to view technological development is to consider it in a balanced manner: social choice involves both purposive innovation and control of undesirable consequences of technology. Water and air pollution, once considered the society's "price of progress," are now variables to be deliberately included in a decision to implement technology (Daddario, 1968; U. S. House, Technology, 1969). The balanced view of technological innovation enormously complicates the role of the governmental administrator for a number of reasons.

First, in a market economy the undesirable consequences of innovation are thought to be the province of government. It is natural that businesses will continue to try to externalize their costs in order to maximize profit. Governments, as protectors of the public health and welfare, are charged to anticipate, regulate and control any deleterious consequences. This is an especially difficult situation for the political decision-maker because it implies responsibility without necessarily conferring means of control (Gregg, 1972).

Second, the incentive and the best information are both on the side of the innovator. In a market economy a full scale assessment of technology prior to its implementation is the exception rather than the rule. Though drugs, pesticides and new point-sources of water pollution are subject to prior regulation, most innovations are not. If phosphates are found to be efficacious cleaning agents, detergent manufacturers use them. When it turns out later that rivers are covered with foam and the eutrophication of lakes has been hastened, public outrage is focused upon government. Though manufacturers of aerosol cans have an incentive to determine that the propellants they use are not immediately toxic to humans, it is left to unaffiliated scientists to discover that fluorocarbons deplete the ozone layer and to public opinion processes to discourage the use of flourocarbons as propellants. In short, the intended consequences of technological innovation will continue to be far better understood than secondary, unintended and deleterious consequences. Businesses will continue to innovate in response to public demand, leaving governments to cope with public outrage at the unintended consequences.

Whether viewed from the positive side of achieving social goals, or from the negative side of controlling undesirable consequences, there is reason to view technological development as a process requiring restraint and direction. At the very least, politicians and administrators need to take a balanced view of the innovations they themselves propose. That is, innovation undertaken at public expense is not for profit but for the "public interest." And approximating the public interest requires that all the consequences of technology be assessed--a proposition much easier to assert than to accomplish. Even the best efforts at prior assessment of technological innovation are hampered by risk and uncertainty.

Risk and Uncertainty

Innovation entails risk. There is

always the possibility that the old way of doing things is better than the new way. In earlier times the impact of innovation was likely to be local, manageable and acceptable. In a technologically sophisticated age an innovation may entail sweeping scale and unmanageable or unacceptable consequences. For example, one certainly does not design a nuclear power plant in order to have a core meltdown. Rather, precautions against the catastrophe are engineered into the design for the plant. Excellent engineering diminishes but does not eliminate the possibility that a core meltdown will occur. Like the nuclear power plant, large scale projects of technological development often entail very low (one hopes) probabilities of disastrous consequences. The core meltdown is an example of a known and therefore theoretically manageable consequence of a large scale innovation. Though it is very difficult to measure the probability, protections are designed into the system. There is also a risk of completely unknown or unanticipated consequences which are not designed into the system. Limitations of present scientific knowledge and synergistic effects of technological innovations considered only separately, are two sources of unknown or unanticipated risk. Again, one hopes that the risk from unanticipated sources is very small indeed. But if it is difficult to assign probabilities to known risks (core meltdown), it is more difficult to assign probabilities to risks yet unnamed (Winkler, 1967; Selridge, 1973).

The problem of risk is complicated by the problem of uncertainty in large scale innovation. Uncertainty is a theoretical problem of measurement. The problem of uncertainty is the problem of assigning probabilities to events in the absence of empirical and historical data. For example, a reasonably acceptable measurement can be made of the risk of driving an automobile on an interstate highway, based upon several years' accumulation of highway accident statistics (e.g. Starr, 1969). No such data base exists for assessing the risk that a nuclear power plant will experience a core meltdown or that a major damn will break in two, flooding the valley below. And given the disastrous nature of the consequences, no one would hope for an adequate historical basis. Decision analytic techniques can be and have been used to assign probability values to undesirable consequences in the face of uncertainty (Rasmussen, 1973; Gilette, 1973, 1974; Fairley, 1975; White and Haas, 1975). At best such measurements are sophisticated conjecture subject to controversy. If there is no controversy among the relevant scientific and technical communities, if all agree what the consequences are and agree on a range of probability of those consequences--then the political decision maker may be justified in proceeding as if there were no problems of uncertainty.

More often than not, however, decisions to innovate are made in a context of scientific and technical dispute, where disagreements among technical experts in the same discipline, between one discipline and another, between experts directly involved in the project and outside experts are common. The political decision maker is left with determining whom to believe and to what degree.

Risk and Benefit

Our society is not a risk-free society, nor do we desire it to be. It is generally necessary to accept some risk to gain some benefit. For the political decision maker a difficult problem is that in large scale innovations the risks and benefits rarely accrue to the same groups in the society. A central question is who is to bear the risk and who will gain the benefit.

Often, the benefits are identifiable, financial, and assignable to specific groups, while the risks are diffuse, unmeasured, potential hazards to health, safety and survival. Because of this the governmental official is under special obligation to consider technological innovation from a balanced perspective: (1) to consider risks as carefully as benefits and costs and (2) to look beyond the evidence of benefits, costs and risks presented by vested interests, to diffuse and uncertain risks, costs and benefits accruing to the unrepresented.

At the risk of infinite regression, one further caveat is in order. Frequently, technology is equated with hardware--machinery with identifiable physical characteristics. But innovations need not be hardware to entail positive and negative consequences for society (Spence and Johnson, 1973). Any planning tool, including program budgeting, models of technology assessment, and the "Quantitative Situational Analysis" recommended here, is a technology. Its use therefore entails risks, benefits and costs to various groups in the society.

Quantitative Situational Analysis

Public managers of water resources are required to consider the opinions of citizens in reaching decisions. Many decisions to innovate--apply new standards of water quality, build a new sewage treatment plant, develop recreational uses of water, or use new monitoring procedures--have direct impact on some citizens and indirect impact on others. Yet "public opinion" seems often to be conflicting, amorphous, or even nonexistent. The problem for the water resource manager is to gather information on public attitudes in such a way that it can be meaningfully incorporated into the process of decision.

In addition to the legal mandate, there are very good reasons for seeking citizens' opinions early in the decision process. The remedies formally available to citizens, such as public hearings and litigation, often occur quite late in the process of decision, when sunk costs are considerable. Engineering studies, selection among the viable alternatives, and time and effort of public and private employees mean heavy investment in a particular decision before citizens have an opportunity to express their preferences. In three cases studies performed in conjunction with this report, citizen opinion was found to have quite different impacts.

The siting of a nuclear power plant is a classic case of the problem of "sunk costs." Citizens organized to oppose the site after alternative sites had been eliminated and after the technical particulars of the plant had been established (Appendix A). Earlier attention to the concerns of citizens might have avoided a protracted process of litigation.

In the case of a plan by the Air Force to dispose of Herbicide Orange, a contaminated lot of the common herbicides 2, 4D and 2, 4, 5T, public input was assiduously avoided in the early stages of planning and testing. The plan was to broadcast and then plow the herbicide beneath the soil of U. S. government land. When local media learned of and reported the plan, public reaction was immediate and hostile, leading to cancellation of this option for disposing of the herbicide (Appendix N). In this case secrecy backfired. The opportunity for a balanced, accurate report of potential (slight) risks was missed by military officials. Instead, when the plan became public, it was seen as a plot to inflict great hazard on the area's citizens. Moreover, the planners had given little consideration to compensating the area citizens for the small but non-zero risks they would be incurring. That is, no benefits were offered the particular citizens at risk. The whole country would ostensibly benefit from final disposal of a troublesome chemical; but the whole country was not taking the risk. Anticipating public reaction might have made the plan, defensible on technical and cost bases, a politically viable option.

In the cases of the nuclear power plant and the herbicide, public opposition came late in the process of decision. The third case presents the water resource manager with the opposite problem: lack of local public interest and concern. The national Safe Drinking Water Act of 1974 mandates more stringent standards for drinking water purity. Yet in three Indiana cities very few citizens expressed concern for the safety of drinking water (Appendix M). Most judged the quality of water by such aesthetic variables as color, taste, and hardness, and simply assumed the water was safe enough. The absence of public concern in this case would lead the water resource manager to be wary of recommending expensive charcoal filtration systems without first implementing a program of public awareness. Resistance to higher water bills could be inferred from information on public attitudes. In all three cases information on public attitudes could have contributed insight to planners and managers.

Quantitative Situational Analysis as an Aid to Planning and Evaluation

To be of genuine use to water resource managers (rather than merely perfunctory performance of a legal mandate), information on public attitudes must be gathered in a clear context. The systematic case study provides such a context. To distinguish it from other forms of case study, the type of analysis here is called a quantitative situational analysis (QSA). By treating an innovation as an opportunity to assess and predict the response of public officials, intensely interested groups, and the general public, the water resource manager has a valuable aid to decision. Systematic analysis before a decision has the added advantage of establishing a firm foundation for post-decision evaluation. Frequently, evaluations must be made without a firm base of data, after the fact. Moreover, a systematic analysis of the consequences of one case of innovation can be instructive in other related decisions.

Many aids to decision help to organize and simplify the substance of a decision. Traditional cost/benefit analysis is the most familiar of these. In a cost/benefit analysis the set of decision-makers is given and it is the decision which is seen as complex. By seeking a single best solution, the cost/benefit analysis assumes that the costs and benefits are spread equitably over the whole society. From the perspective of the water resource manager, there are several problems with traditional cost/benefit analysis as a single aid to decision.

First, the manager operates in a socially and politically complex setting. The process by which a decision is reached and implemented may be as complex and diffuse as the substance of the decision to be made. A single manager of water resources rarely is in a position to make and implement a decisio to innovate. Rather, the authority is divided among persons in an agency, among agencies at the local or state level, between state and federal officials and so on. Implementation depends upon the enthusiasm, or at least acquiescence of public agencies, businesses, and citizens whose behavior or situation is to be changed by the innovation.

An aid to decision which helps to organize the political complexity surrounding a decision can put the decision in an appropriate perspective. Traditional cost/benefit analysis is less helpful in this regard, since it assumes that a given set of decision-makers have the capacity to act unilaterally.

The second problem with traditional cost/benefit analysis is that it assumes costs and benefits are equally distributed. Yet in the real world some people are benefited and others are adversely affected by an innovation. The distributive nature of benefits, costs and risks is the source of much of the social and political conflict which accompanies innovations in water resources. In the herbicide orange case, for example, the assumption that the "public interest" might be served by burying the herbicide in Utah was challenged by vociferous opposition from local groups. An understanding of the distributive impacts of costs, risks and benefits accruing from contemplated innovation may be critical to efficacious policy-making. As a decision aid, the systematic case study (QSA) can assess distributive impacts and suggest effective recompense to groups adversely affected by proposed innovations.

The third problem with cost/benefit analysis is that it frequently assumes omniscience on the part of the analyst or manager. It is assumed that anyone familiar with an innovation can think of all the likely consequences of the innovation, weigh them appropriately, and incorporate them into an analysis. Hypothetical role-playing, putting oneself in the position of someone positively or adversely affected, can help to anticipate resistance or support. But to be reliable, people's perceptions of how they stand to gain or lose from an innovation must be gathered directly--by asking them. It is too much to ask of a water resource manager that he or she be competent in the technical and organizational aspects of the position and also be so flexible in values and so broad in perspective as to anticipate the likely reactions of all affected groups. A technique which assesses likely reactions empirically is therefore more reliable than cost/benefit analysis in anticipating support for and resistance to innovation.

Designing a Quantitative Situational Analysis: The Qualitative Stage

Most managers of water resources operate in a socially and politically complex environment. Yet most planning aids are primarily technical or mechanical in nature. The quantitative situational analysis is a planning tool which goes beyond the technical to organize the social and political dimensions of water resource management.

Establishing boundaries of the situation. Defining the parameters of any case study involves judgement and selection. A case study is always a case study of something: a problem, an innovation, a hypothesis. By definition a case study is a single instance of a larger class of events. Establishing the boundaries of the case to be studied is therefore not automatic. The boundaries depend upon the analyst's determining what the case study is of, what information is needed and appropriate.

Establishing the boundaries of a situational analysis may be more or less difficult (and more or less arbitrary), depending upon the problem to be investigated. An analysis of a series of decisions leading to building or not building a larger sewage treatment facility in a particular community, is fairly clearly bounded geographically and in time. An analysis to determine whether drinking water for an area or state is "safe enough" requires considerably more judgement to establish the boundaries. The three quantitative situational analyses performed in conjunction with this report--the nuclear power plant, Herbicide Orange, and the safe drinking water cases--had a largely theoretical orientation. Specifically, studies were performed of social and political processes of decision about technologically complex innovations with low probabilities of disastrous consequences involving water resources. The several underlined phrases each contributed to the identification, selection, and boundaries of situations to be analyzed. The manager of water resources is likely to adopt a more practical rather than theoretical orientation. Indeed, the topic for study may be obvious to the water resource manager. Some guidelines are then needed to design and perform the analysis.

Chronology of events and decisions. A carefully detailed list of events and decisions leading to the current situation can be valuable in determining appropriate parameters. A decision to consider a new sewage treatment plant may be prompted by an event as definite as a statutory change in the required quality of effluent or as gradual as an increasing population overtaxing current facilities. Two examples will help to make clear the purposes of a chronology.

Chronology in Safe Drinking Water. The passage in 1974 of the federal Safe Drinking Water Act (SDWA) formally altered national policy on the safety of drinking water. As with most legislation, nothing happened immediately to alter the safety properties of the water being delivered to citizens across the country. The needed chronology begins with passage of the Act and continues to the present, or until local supplies conform to new standards. There are many events and decisions between.

Since drinking water is actually delivered by private and municipal companies, the analysis must include one or more particular local areas. The water resource manager in Indianapolis has no direct investment in the compliance or non-compliance with the Act of water supplies in Albany. The chronology should therefore focus on decisions and events of particular importance to Indianapolis and Indiana. Since the legislation specifies that the Environmental Protection Agency (EPA) will promulgate interim and final standards, the target dates for these standards (especially if met by EPA) are important events in the chronology. The legislation also specifies that states are to take over primary enforcement from the EPA Regional Offices, upon submission of an acceptable set of primary standards. (See Appendix M) The date of acceptance of primary enforcement by the state, and events, negotiations and decisions leading to it are also important inclusions in the chronology. Notice that the third level of analysis, the state, has been added to the federal and local levels as an important focus of study for the situational analysis. A combination of statutory provisions (SDWA), logic (only local companies deliver water), particular interest (Indianapolis rather than Albany) and the authority to affect the decisions (state is included because it will presumably take over primary enforcement and is already involved in testing samples and certifying water delivery systems), determine the preliminary boundaries of a situational analysis. Federal, state and local legislation mandating changes in water resources policy are common sources of impetus for innovation. And frequently a QSA can assist the water resource manager in deciding how to respond to legislatively mandated changes.

Chronology in Herbicide Orange. The plan to dispose of Herbicide Orange by burying it in Utah is different in a number of respects. The plan was one of several being considered at the time by the Air Force and as such had no formal legislative impetus. Most of the planning and investigation were internal to a single, though complex, organization. Fairly elaborate plans had been developed prior to the consultation with state officials, in part because alternative sites and methods of disposal were also being considered. The QSA might, of course, have involved all the alternatives for disposal being seriously considered. Under constraints of time and resources, a detailed study of the single alternative (burial in Utah) was chosen over a less detailed study of all the options. Such choices of scope are endemic to performing quantitative situational analyses.

Developing a Chronology. For the water resource manager, developing a chronology of important events and decisions may be as simple as sorting through documents readily available. More frequently, perhaps, some investigation is involved. Table 1 lists sources of materials for developing chronologies. The list is meant to be suggestive, rather than exhaustive. The sources are of two kinds. The first kind relates directly to the situation under investigation. Pertinent statutes and administrative directives at local, state and federal levels are at once events in the chronology and sources of further information. Other governmental documents, including testimony in hearings on legislation, Environmental Impact Statements or their equivalent, government organization charts detailing authority for decision-making, press releases and news stories, articles in trade and technical periodicals, and engineering or other technical reports all are likely sources of information for compiling a chronology.

The second kind of source can assist in locating the first. Case studies or general studies on appropriate topics already performed by others can be valuable in focusing the QSA. For example, a study of a decision to expand waste treatment facilities in a distant community may already have detailed pertinent events and decisions at the federal level. At the least, such studies provide background on the kinds of issues involved and on the sources of active support and opposition which might be anticipated. The libraries of Water Resources Councils in the fifty states are good places to find such related studies.

Conceptualizing the situation: structure of authority and impact. A chronology is simply a list of decisions and events. The next stage of analysis uses the chronology and other sources to give shape to the context of decision. The first step is to generate an "organization chart" of those with formal authority for decisions. If the chronology has been reasonably well developed, much of the organization chart is readily apparent. The organizational chart for the QSA on safe drinking water is presented in Figure 1. Generally, if the major decisions are known it is also known who (what legislative bodies, governmental agencies, private companies, and so on) made the decisions. Begin by making a *list of the political institutions and agencies with some formal authority (or power) over the relevant decisions*. Expand from a list to a chart by specifying levels of government and formal relationships of one institution or agency to another. It may be like solving a puzzle to identify what agencies have authority over *drinking water* supplies, as distinct from recreational uses of water, sewage

Table 1

WRITTEN SOURCES FOR DEVELOPING A QUANTITATIVE SITUATIONAL ANALYSIS

Sources specific to case under analysis	General sources
Statutes and ordinances	Case studies on related innovations in other areas (Often available from water resources council libraries in the 50 states).
Administrative directives and procedures	Articles in *Congressional Quarterly*, *National Journal* and other periodicals dealing regularly with policy issues.
Testimony in hearings	Articles in trade and technical periodicals.
Environmental Impact Statements	Books on interviewing, questionnaire design, and other survey research procedures.
Engineering Studies	
Records of court proceedings	
Press releases and news stories	
Articles in trade and technical periodicals	
Organization charts of governmental departments and agencies	

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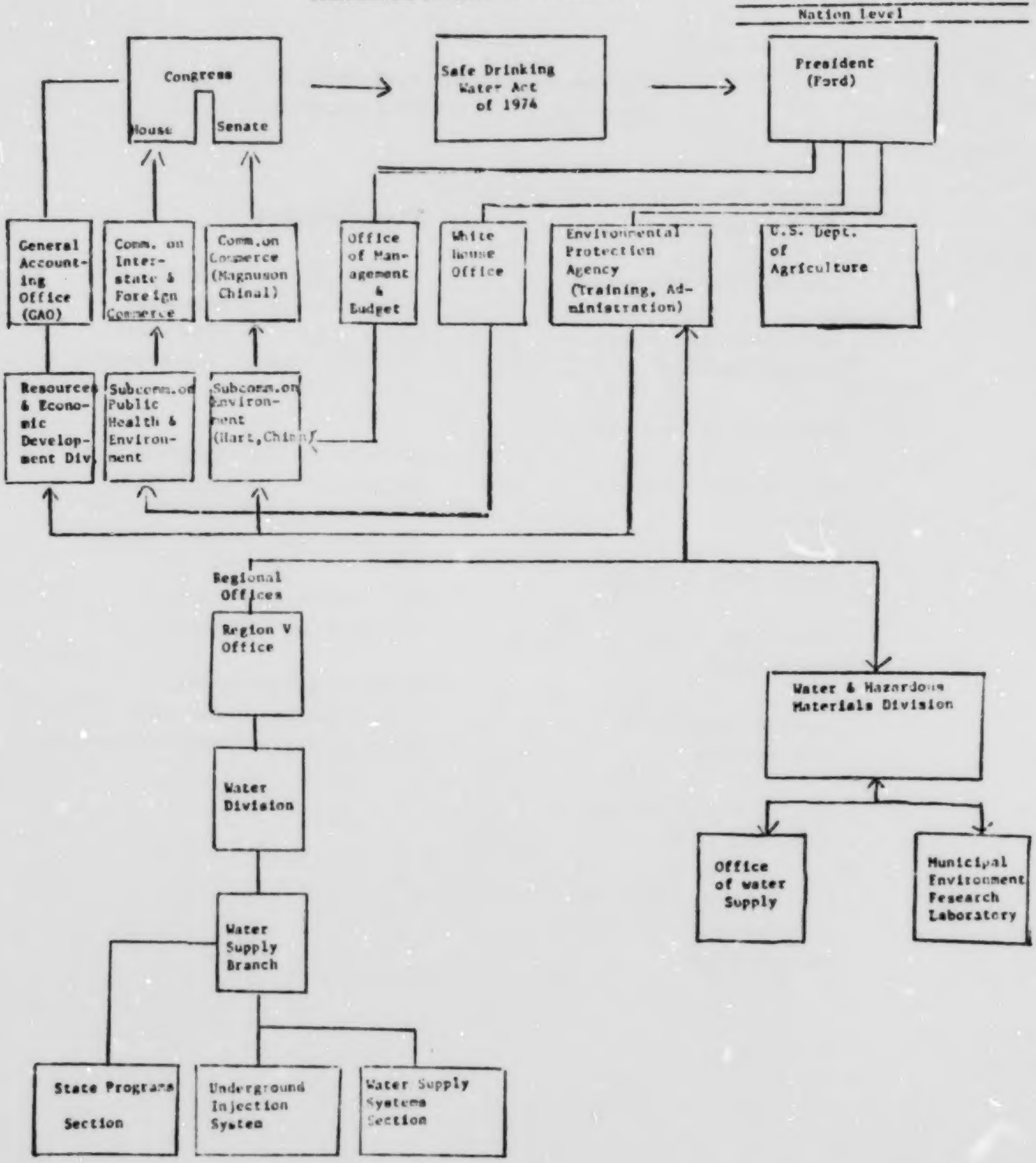
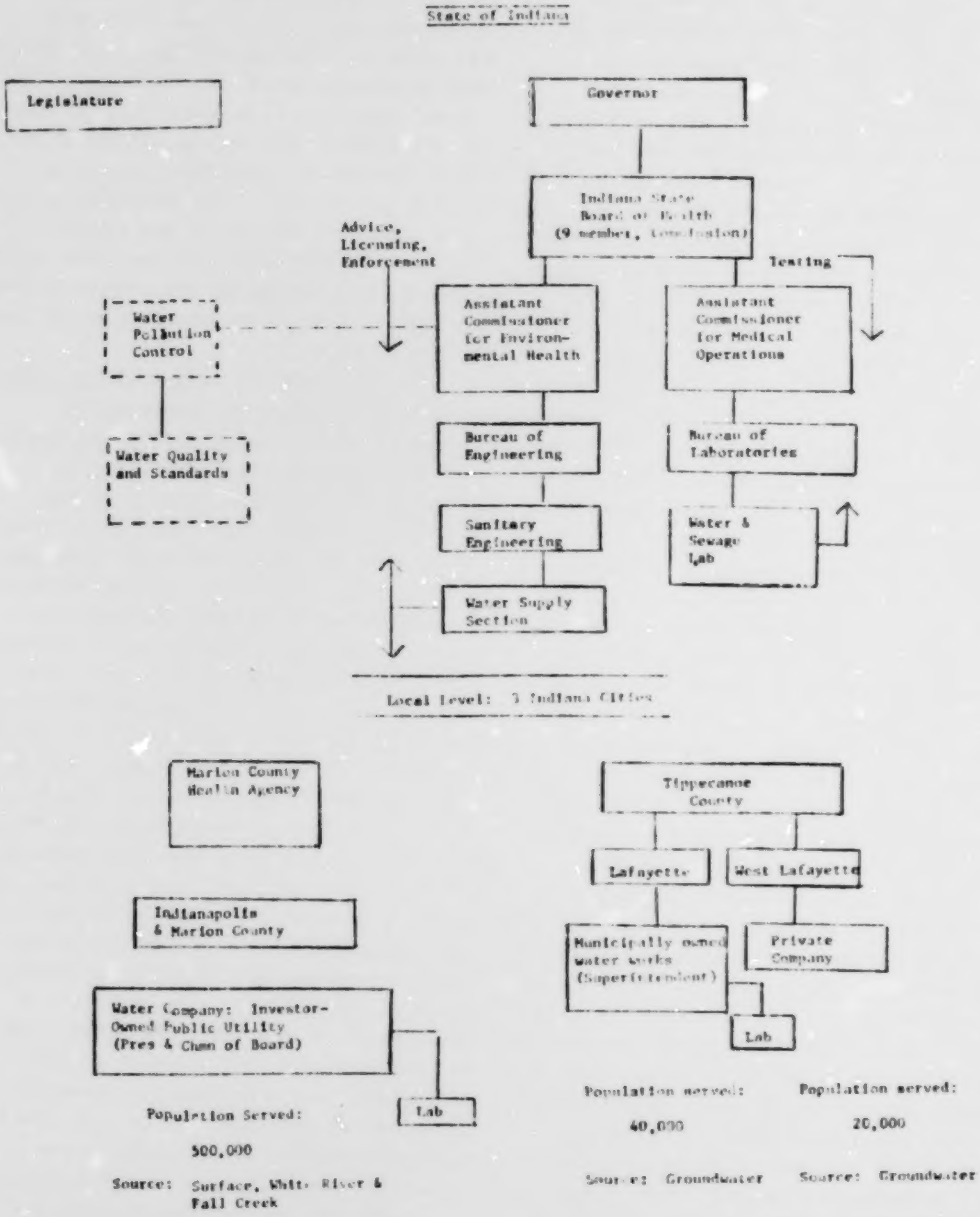
FIGURE 1

ORGANIZATIONAL CHART FOR QSA ON SAFE DRINKING WATER:

GOVERNMENTAL AGENCIES AND OFFICIALS


Nation level
Congress
House
Senate
Safe Drinking Water Act of 1974
President (Ford)
General Accounting Office (GAO)
Comm. on Inter-state & Foreign Commerce
Comm. on Commerce (Magnuson Chinal)
Office of Management & Budget
White House Office
Environmental Protection Agency (Training, Administration)
U.S. Dept. of Agriculture
Resources & Economic Development Div.
Subcomm. on Public Health & Environment
Subcomm. on Environment (Hart, Chinn)
Regional Offices
Region V Office
Water Division
Water Supply Branch
State Programs Section
Underground Injection System
Water Supply Systems Section
Water & Hazardous Materials Division
Office of water Supply
Municipal Environment Research Laboratory


State of Indiana
Legislature
Governor
Indiana State Board of Health (9 member, Commission)
Advice, Licensing, Enforcement
Testing
Water Pollution Control
Water Quality and Standards
Assistant Commissioner for Environmental Health
Assistant Commissioner for Medical Operations
Bureau of Engineering
Bureau of Laboratories
Sanitary Engineering
Water & Sewage Lab
Water Supply Section
Local Level: 3 Indiana Cities
Marion County Health Agency
Indianapolis & Marion County
Water Company: Investor-Owned Public Utility (Pres & Chmn of Board)
Lab
Population Served:
500,000
Source: Surface, White River & Fall Creek
Tippecanoe County
Lafayette
West Lafayette
Municipally owned water works (Superintendent)
Private Company
Lab
Population served:
40,000
Source: Groundwater
Population served:
20,000
Source: Groundwater

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treatment and ambient water quality. Again, some selection and judgement are involved. The boxes around "Water Pollution Control Branch" and "Water Quality and Standards Section" in the chart for Indiana (Figure 1) are in dashed lines, indicating that these agencies were not studied directly. Parallel agencies in EPA and EPA Region V are simply omitted from the figure. Clearly, there is considerable relationship between ambient water quality and the safety of delivered drinking water, especially when the drinking water is drawn from a surface source. Similarly, the effectiveness of sewage treatment upstream may affect the quality of delivered drinking water downstream. In the QSA performed, the decisional structures surrounding both ambient water quality and sewage treatment were eliminated from direct study. Given a slightly different focus, for example the impact of ambient quality on delivered water, it would have been vital to include these decisions and the institutions with authority to make them. Since our focus was on perceptions of the safety of drinking water, the variable of ambient water quality was included only by selecting for study one local supply with a surface water source and two with (presumably naturally safer) ground water sources. Wherever possible, it is preferable to limit the scope of the situation to be studied by deliberate choice, rather than by accidental omission. In this way, the omitted agencies can be incorporated later if necessary; or their impact can be determined indirectly, (as by including ground and surface supplies in the local areas studied).

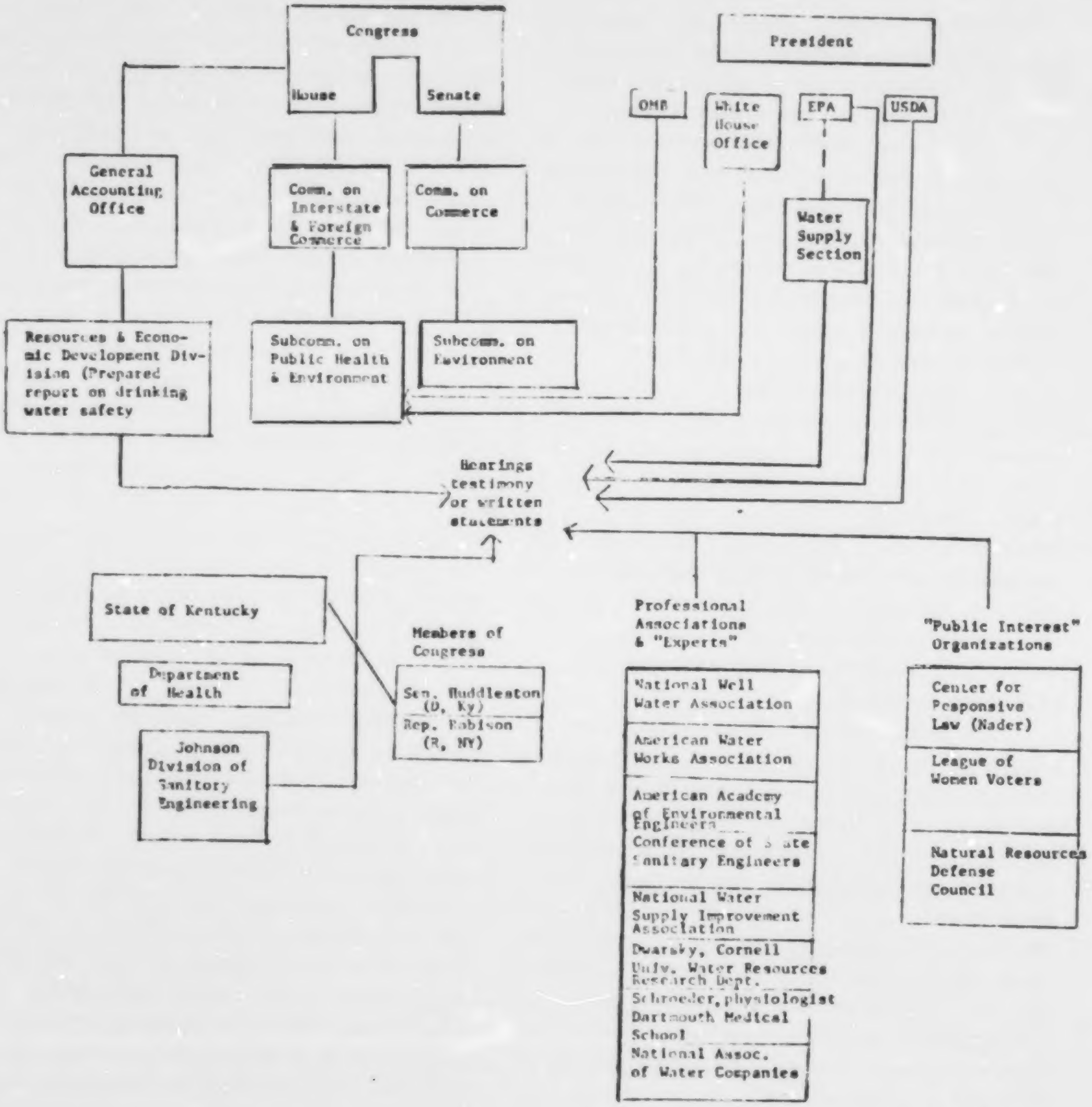
That there are likely to be errors, omissions and unknowns in specifying the formal relationships of authority is one good reason for going beyond this stage of analysis to the interview stage. In an interview an official can say immediately that, though the title sounds appropriate, he or she is concerned with an utterly different (and from the perspective of the analysis, irrelevant) aspect of policy. Even creating a chart of formal authority can be instructive, however. Though the QSA's reported here were performed by academic "outsiders," the water resource manager who performs such an analysis is quite likely to appear on the chart. The exercise of generating the chart may give a better perspective on the responsibility for and authority over the problem or innovation at issue.

The next step is to expand the chart of formal authority by incorporating agencies, institutions, groups and individuals with some informal authority or advisory function with respect to the decisions. Figure 2 presents an expanded version of the formal chart for drinking water at the federal level, incorporating the groups who exercised informal or advisory functions in the decision to pass the Safe Drinking Water Act. The same sources useful in preparing the chronology (Table 1) are useful in identifying informal and advisory decision-makers. For example, most of the groups in Figure 2 either testified in hearings on the SDWA, or filed reports which were mentioned in the record of the hearings. The list (or chart) of groups, agencies and individuals with informal decision-making authority must be considered especially tentative prior to interviewing. For example, a decision maker may well feel constrained to reflect a dominant interest in the community, even if no one representing that interest has contacted him or her directly. Such perceptions of constraint are more likely to emerge in a carefully structured interview than in the "imaginative" and "library" stages of analysis so far described. Almost invariably, informal

FIGURE 2

EXPANDED ORGANIZATIONAL CHART ON SAFE DRINKING WATER:

Direct Participants at Federal Level,
Based on Testimony in Senate Hearings
& Reports on House Hearings


Congress
House
Senate
President
OMB
White House Office
EPA
USDA
General Accounting Office
Comm. on Interstate & Foreign Commerce
Comm. on Commerce
Water Supply Section
Resources & Economic Development Division (Prepared report on drinking water safety
Subcomm. on Public Health & Environment
Subcomm. on Environment
Hearings testimony or written statements
State of Kentucky
Department of Health
Johnson Division of Sanitory Engineering
Members of Congress
Sen. Huddleston (D, Ky)
Rep. Robison (R, NY)
Professional Associations & "Experts"
National Well Water Association
American Water Works Association
American Academy of Environmental Engineers
Conference of State Sanitary Engineers
National Water Supply Improvement Association
Dwarsky, Cornell Univ. Water Resources Research Dept.
Schroeder, physiologist Dartmouth Medical School
National Assoc. of Water Companies
"Public Interest" Organizations
Center for Responsive Law (Nader)
League of Women Voters
Natural Resources Defense Council

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authorities who have not come to light in written accounts will be mentioned in interviews.

The chart is expanded further by *identifying institutions, groups, and agencies with appellate authority in the decision process*. This amounts to specifying where the decision will be (was) made if some groups are (were) sufficiently dissatisfied with initial decisions that they attempt(ed) to change the *locus* of decision. Litigations; appeals to governor, president or local chief executive officer; and lobbying for legislative change are frequent channels of appellate authority. Occasionally a quantitative situational analysis is an *ex post facto* investigation of a completed decision process. To be of use to the water resource manager, the QSA is more likely to begin while the final outcome is still in doubt. Specifying appellate authority helps to insure that agencies and officials who may in the future affect the final outcome are included in the analysis. Case studies of similar innovations are a good source for identifying institutions with appellate authority.

The next step in the analysis is to *expand the organization chart once more by incorporating groups and citizens who are not directly involved in the process of decision but who are or might consider themselves to be affected by the decision*. Often these groups and unorganized citizens can be defined *geographically*. In the case study on drinking water three Indiana cities had been identified for intensive study. The consumers served by the three water delivery systems under study were, rather obviously, "affected citizens". It is they whose water was perceived to be safe or unsafe; they who might have to pay increased water bills for technological innovations or new testing procedures to make it safer. In the herbicide case study defining "affected citizens" was more problematic. It *might* have been assumed that since the herbicide was to be disposed of on unpopulated federal land, no citizens were affected. This assumption of "no affected citizens" would have been difficult to defend on *technical* grounds, since absolute containment of the herbicide on federal land could not be assured. Aerial drift and slow contamination of the water table were slight but conceivable risks associated with the plan. The assumption of "no affected citizens" is even more difficult to defend on *political* grounds. When the plan became public it was reported, and apparently perceived by citizens as a threat to the whole state of Utah. That is, "Utah was being used once more as a convenient federal dumping ground." In performing a quantitative situational analysis it is well to be as inclusive as possible in anticipating citizens likely to consider themselves affected by the decision or innovation. Arbitrarily deciding that no citizens are affected defeats the purpose of the analysis.

In addition to geographic definition of affected citizens, other pertinent variables are economic, occupational and ideological. For example, poor citizens *might* be more reluctant to accept higher water bills than those relatively well off; those who act in capacities related to an innovation may have more information on it and thus perceive themselves to be directly affected while others do not; and active environmentalists or political party leaders may have more interest in policy change and thus more clearly developed attitudes toward proposed innovations. Once more, the definition of affected citizens should be considered preliminary. Those who consider themselves to be affected cannot always be anticipated from the armchair. Many can be anticipated by asking such questions as: Whom is the innovation intended to benefit? Who will pay for it? Whose situation or behavior will be altered by the innovation? What citizens and groups will incur some risk and/or cost if the innovation is implemented?

Identifying consequences, issues and concerns. The organization chart has now been completed on a tentative basis. It organizes decision-makers and affected groups structurally by identifying formal and informal relationships. The next stage of analysis seeks to define the value space in which each decision-maker or group of citizens perceives the decision or innovation. For convenience, those actively engaged in some aspect of the decision process e.g., governmental agencies or officials, private businesses, or their representatives, organized interest groups, or their spokespersons--will be called "direct participants." Members of the public who do not directly participate in the process but who are or may consider themselves to be affected by the innovation will be called "affected groups." The object of this stage of the analysis is to perform a cost/risk/benefit analysis from the perspective of each direct participant and each affected group.

The first step is to identify as accurately as possible what the issues and concerns are of the direct participants and affected groups. The traditional cost/benefit analysis assumes that all parties to a decision have a "complete set" of preferences concerning a decision to innovate. In the empirical world this frequently is not the case. Consider once again the expansion of the hypothetical sewage treatment facility. A water resource manager may see the plan primarily as "a new facility required to meet mandated effluent standards." One city councilman may see it primarily as "an opportunity to acquire federal matching funds, bringing new money and jobs to the area," while a second councilman sees "another vote on a bond issue following closely upon the more critical school bond issue." A local construction firm may see it primarily as "a $3 million contract." A citizen who has lived in the community for twenty years may see it primarily as "an expensive facility to treat the wastes of residential and industrial newcomers, for which I am going to have to pay," and so forth. That is, decision participants and affected groups have quite different perspectives on an innovation, depending on their situations, level of information, and perception of how the innovation will change things.

The same sources (Table 1) used to develop the chronology and the organizational chart can be used to develop a preliminary list of issues and concerns. Table 2 presents the groups and individuals who testified in the U.S. Senate on the Safe Drinking Water Act, categorized by the types of issues and concerns they discussed in the hearings on the bill. Table 3 expands upon Table 2 by incorporating the analyst's concerns (that is, the hypothetical water resource manager performing the QSA) and those of the general public as nearly as can be anticipated at this stage of analysis. For completeness, the tables should include all the governmental agencies, other direct participants and affected groups identified by the final organizational chart. In Tables 2 and 3, for example, state and local officials and interest groups are conspicuously absent. They are left out here solely because the table would become rather cumbersome for illustration.

Preparing a table such as Tables 2 and 3, in which direct participants and affected groups are arrayed by the issues of greatest concern, can serve several purposes. The most obvious is that the degree of overlap of concerns is readily apparent. If all groups see the innovation as raising approximately the same issues, there may be considerable room for negotiation. On the other hand, if governmental decision-makers see the innovation in fundamentally different terms from organized interest groups, opposition to ordinary processes of decision may be anticipated. Notice from the definitions at the bottom of Table 2 that groups often have opposite positions on shared concerns. Several groups considered the question of informing or not informing the public when water does not meet federal standards an important issue. But EPA and the National Association of Water Companies were opposed to notifying consumers routinely, while the Center for Responsive Law and the Natural Resources Defense Council favored routine notifications. The table categorizing the issues of concern, whatever the position, serves to highlight the issues or variables each direct participant and affected group considers most important in arriving at a position on the innovation.

To illustrate further, including the analyst's concerns in the table can point out the relative "acceptability" of his or her perspective. It should be readily apparent that exclusive emphasis on cost and technical considerations is too narrow a base from which to launch a successful innovation. The analyst performs the QSA partly to discover whether his or her initial perspective is "appropriate" as seen by other direct participants and by affected groups.

There is a lack of overlap (Table 3) between the concerns of direct participants and those of affected groups (consumers of drinking water in general and in three Indiana cities). The lack of overlap was confirmed in interviews but was suggested by comments in the hearings on the Safe Drinking Water Act. Frequent references were made to the lack of public attention to the safety of drinking water. And these comments were made by direct participants with quite different perspectives on SDWA. That is, citizens were not simply discounted as apathetic by one official with a clear benefit from public apathy. Rather, citizens were described as apathetic by those who stood to gain and to lose by an uninterested public. Moreover, many of those who testified were presumably in a good position to know about levels of citizen interest and awareness. That the safety of drinking water is a non-issue for many citizens, and that their interest in drinking water is other than safety, therefore became a working hypothesis, incorporated into Table 3. The "experts" can, of course, be wrong. For a major innovation the QSA should probably be carried to the interview stage so that the response of direct participants and affected groups can be measured and a quantitative analysis can be performed.

The necessary materials have now been accumulated to perform a qualitative, or descriptive, cost/risk/benefit analysis for several of the direct participants and affected groups. (Too little will be known about some participants and groups to enable a confident assessment.) The analysis of each direct participant and affected group may well be no more than a paragraph or two, specifying the relative degree of authority for the decision (Organization Chart), the primary issues of concern (Table 3), the position on each of these issues, and putting these things together in an intuitive way, the likely support of or opposition to the proposal innovation.

TABLE 2:

Issues and Concerns of Direct Participants Testifying on Senate Hearing on Safe Drinking Water Act

	Federal Standard Setting: Surface and/or ground sources	Technical aspects	Risk	Public input	Level of enforcement	Testing problem	Cost
Comptroller General	X						X
U.S. Environmental Protection Agency	X			X	X		X
U.S. Department of Agriculture	X	X			X		X
Resources and Economic Development Division, GAO	X	X	X			X	
Representative Robinson (R,NY)					X		
Johnson, Div. of Sanitary Eng., KY.							
Senator Walter Huddleston (D,KY)	X	X					X
Center for Responsive Law (Nader)	X	X	X	X	X	X	X
League of Women Voters	X	X	X	X	X	X	X
National Water Well Association	X	X			X		X
American Water Works Association	X	X	X	X	X	X	
American Academy of Environmental Engineers	X	X			X	X	X
Natural Resources Defense Council	X	X	X	X	X	X	
Conference of State Sanitary Engineers	X	X		X	X	X	X
National Association of Water Companies	X			X			X
National Water Supply Improvement Association	X	X			X	X	X

A definition of each of the categories follows:

Federal standards is the question of whether the federal government should establish and enforce standards for intrastate water supplies. Also at issue is whether federal regulation should be confined to surface sources, or include groundwater sources as well.

Technical aspects include the personnel availability and training, collection, surveillance, and testing of samples, certification of water suppliers and other such procedural or operational factors.

Risk is the realization and/or policy towards the threat of disease or sickness or death due to contamination of the water supply by chemicals, bacteria, or radioactive substances, including the relative risk from surface and groundwater supplies. It could be stated that there is an implicit realization of risk due to the mere fact that these groups have voiced their concern. But, many groups consider this one of their major issues or the major issue while other groups are more interested in another category.

Public input is the participation from the general citizenry that is wanted or not desired. Public input also involves the question of how much to inform the public as to the condition and/or non-compliance of the water samples in view of the national standards.

Level of enforcement involves the question of which governmental level shall be responsible and accountable for the enforcement of the standards--state, federal or local or a combination.

Testing problems involve the questions of what to test for, how much, what the levels should be. The questions of risk is in this instance implicit as one must evaluate the costs vs. benefits from testing one substance and not another.

Cost can be either the cost of implementing the programs as to enforcement and testing on the state and local levels, or the financing of research, training, and local and direct grants to water suppliers.

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The analysis should also include the participants and groups which generally share the perspective of the one under analysis; and the participants and groups with conflicting perspectives and positions.

Having performed these separate analyses, the water resource manager is now in a position to reflect upon the need for further analysis. If all direct participants agree what the costs, risks and benefits are of the proposed innovation (shared value space) and agree that the outcome is positive (shared positions on issues) and if affected groups are actively supportive or generally predisposed toward the innovation, it may be "safe" to stop analysis at this point and proceed to implement the innovation. If the picture is mixed e.g., conflict among active participants with considerable authority, or conflict between governmental authorities and organized groups of citizens, or insufficient information to perform a cost/risk/benefit analysis for affected groups--it is wise to proceed at least one step further with the analysis before making a definite decision to proceed with, alter, or abandon the innovation.

In either case, the water resource manager who has performed a QSA to this stage has an improved perspective on a proposed innovation. For example, do those whom the innovation is intended to benefit seem to agree they will be benefited? Are there unanticipated issues, or sources of opposition? If so, is an alternative innovation less likely to encounter opposition? That is, can adversely affected participants and groups be compensated? Or might an alternative site, or set of standards, or technical options meet the objections of those adversely affected? Was the analyst's initial perception of the costs, risks and benefits of the innovation "accurate" or "appropriate" as others see it? Why? How? Is general awareness of the innovation and its intended benefits "correctly" perceived? Are the costs and risks well understood? That is, is a campaign of public awareness needed? Might the analysis itself be of use to other direct participants (especially governmental decision-makers)? These kinds of questions, important in making defensible decisions on innovation, can be asked and answered with more confidence after performing at least the initial "library", or "qualitative" stage of a quantitative situational analysis.

Performing a Quantitative Situational Analysis: The Quantitative Stage

A major consideration at this point is the level of information (amount, detail, and scope) which will be required to reflect the positions of the direct participants and the affected groups. For certain limited purposes it may be that the initial risk/cost/benefit concerns indicated in the preceding "armchair" (qualitative) stages of the QSA will suffice (e.g., upgrading water treatment facilities in a community which is already largely aware of both the necessity and cost of such innovations, and support has already been voiced.) Other projects which impact differentially on a broader segment of the community will require direct but possibly informal input from representatives of these various segments of the community. Still larger scale projects, which involve large regions within a state or across several states (e.g., the development of a large recreational reservoir), would require a full scale analysis: acquisition of direct input from representatives from all direct participants, potentially affected and/or concerned groups of citizens, community officials, state officials, federal officials, and business and industrial leaders in the areas affected.

Most of these groups will have been identified earlier in the process. Nevertheless, it may well be necessary to add some groups and delete others as the analysis proceeds.

The water resource manager preparing the QSA should bear in mind that the purpose of the data collection is to identify and document, in standard form, the nature and scope of concerns of all groups directly and indirectly involved in and affected by proposed innovation.

The amount of information required of the different groups and the number of groups which must be queried to obtain a useful QSA is primarily dependent upon three factors: (1) the number of politically influential groups affected (positively or negatively) by the project; (2) the geographic area affected by the project; and (3) the degree of controversy anticipated. Two readily available indicators of the degree of controversy that may be anticipated are: (1) the number and political influence of groups which may perceive themselves as adversely affected without compensating benefits, and (2) the extent to which the project has direct, easily identifiable risks and costs, and only diffuse, difficult to identify benefits.

In general, the more groups affected, the more politically influential the groups affected, the larger the region affected by the project, and the more inequitable the distribution of risks, costs and benefits, the more information should be collected. Other factors which might enter into this determination are the diversity of possible effects and the political history of similar projects. In general, a little more information from marginally affected groups is to be preferred to having no information or inadequate information on the views of potential opponents.

Collection of the data. There are essentially four steps involved in the collection of the data base for the QSA. (1) A preliminary version of the data collection instrument must be developed. This will be based primarily on the documentation assembled earlier. (2) The preliminary version of the data collection instrument must be pilot tested. This provides an indication of the comprehensibility of the instrument to various groups, and an indication of the adequacy of the initial conceptualization of the risk, cost, and benefit issues for the various groups considered. (3) The data collection instrument (typically) must be revised in light of the experiences gained with the pilot test. Also, at this point a code book should be developed to aid in the rapid categorization of the data as it is collected. And (4) the data collection instrument is administered to representative samples of individuals from the previously identified groups. Each of these steps will be considered in more detail in succeeding sections along with some related issues. Before approaching the issue of instrument design it is necessary to touch on the problems of obtaining representative samples from the groups identified in the chronology of events and the organization chart.

Selection of representative samples. There are two types of sampling problems. In broad terms these are related to getting representative information from the groups and individuals who exercise direct control over one or more aspects of the decision process, (direct participants) and to getting such information directly from the various subgroups in the population who are directly or indirectly affected by the decision (citizens).

Sampling of Direct Participants. For a small local group such as a city council, each member may have independent influence and should be queried. At the state governmental level it would be maximally desirable to obtain the necessary information from all members of the legislative committees or subcommittees which would have direct influence on the decision. In the same fashion, those particular individuals within a state or Federal regulatory agency who would have direct influence over the decision should be identified, and in so far as possible all queried. When eliciting positions from large organizations--businesses, industries and interest groups--the best rule is to begin at the top of the organization. The president or chairperson often will both accept the role of spokesperson and refer the investigator directly to the appropriate subordinates.

Sampling Affected Groups in the General Population. The reliability of the information obtained in any type of survey is directly affected by the adequacy of the sample. In general, a well drawn small sample will permit reasonably accurate inferences to be drawn. Table 4 provides two examples of the effect of sample size on the reliability of the estimate of the proportion of a group who would agree (or those who would disagree) on some issue.

Two principles of sampling are discernible from Table 4. First, the more evenly divided the population of interest is over an issue, the larger the sample that is necessary to determine with reasonable confidence the majority position. For example, a sample of size $\underline{n}=50$ would suffice if the respondents were running 7:3 in favor of the project. A sample of size $\underline{n}=150$ would be necessary to have the same degree of confidence in the majority position if the respondents were running only 6:4 in favor of the project.

The second readily apparent fact is that the accuracy of sample estimates increases in relation to the square root of the number of sample cases, not their total. Thus, increasing a sample from $\underline{n}=25$ to $\underline{n}=50$ shrinks the confidence interval by 12%, while an increase in sample size from $\underline{n}=175$ to $\underline{n}=200$ shrinks the interval by only 1%. Indeed, to obtain a comparable reduction in the confidence interval over that for a sample of 175 cases, one would have to use a sample containing more than 2000 cases. In most instances, the water resource manager will be proposing projects which, because of the necessary financial costs, will require fairly high levels of general support. Accordingly, relatively small samples ($n=100$ to 250) will be quite adequate to estimate with some reliability whether or not the requisite high support is present. And, in almost no instance would a sample of a size greater than 500 be necessary. Indeed, the primary function of larger samples is to assuage the doubts of local political leaders, and the leaders of special interest groups who might be opposed to the project.

The development of a preliminary interview/survey schedule. The primary point in all phases of data collection is the comparability of data from various groups. The principle of comparability is important whatever the scope of the QSA. But comparability does not necessarily mean that identically worded questions will be asked of each person interviewed. Rather, questions related to the issues of interest should be presented to each relevant group at a level of detail, and in terminology each group can understand. Examples of this approach are found in Table 2 of Castore & Nicholson (1977), Appendix A.

A preliminary interview should be conducted with at least one person in each

Table 4

Confidence intervals around an observed P of .40 with different sample sizes under the assumption of simple random sampling

Sample Size	Range of the 0.5 confidence interval for observed P=.40	Range of the .05 confidence interval for an observed P=.30
1500	.375- .425	.277- .323
1250	.373- .427	.275- .325
1000	.370- .430	.272- .328
750	.365- .435	.267- .333
500	.357- .443	.260- .340
250	.339- .460	.243- .357
200	.332- .468	.236- .364
175	.327- .473	.232- .368
150	.322- .478	.227- .373
100	.304- .476	.210- .390
75	.289- .511	.196- .404
50	.264- .536	.173- .427
25	.208- .592	.120- .480

Note: The 0.5 confidence interval represents a range which, given an observed Proportion in a particular size sample, 95 times out of 100, would contain the true Proportion value for the population. Relatively exact confidence intervals for any particular P for sample sizes of 10, 15, 20, 30, 50, 100, 250, and 1000 may be estimated from the Pearson-Hartley (1958) charts.

Source: Pearson, E.S. & Hartley, H.O. Biometrika Tables for Statisticians, (London, UK: The Cambridge University Press, 1958). Vol. 1. 2 ed.

of the groups identified during the qualitative phase. Even a preliminary interview has a pre-established structure to ensure comparability. The questions will be open-ended (e.g. Do you personally believe there are any problems concerning the safety of public water supplies in Indiana?), so that concern or the lack of it is expressed in the respondent's language. Each of the questions used at this point should be followed by a number of probes, such as, "Could you tell me a little more about what you mean by ________" or, "Where you said you were concerned about ___________, did you mean "x" or "y" or perhaps some combination of these, or something different?"

Care must be taken to keep these preliminary interviews an unbiased as possible. At the same time that you are attempting to get as complete a picture as possible of their group's position and concerns, the interviews must not be leading, or make attempts to persuade the respondent. Above all else, the interviewer must not project his own itital values into the situation. He must guard against practices such as asking for more detail on those issues which he feels a priore should be of concern to a particular group and less detail on others. In short, he must beware of creating a self-fulfilling prophesy at this point--finding only what his initial armchair analysis leads him to anticipate. At the same time, he must be careful not to create attitudes where none previously existed.

Finally, in this preliminary stage, one should be sensitive to, and even solicit, suggestions from the interviewees (respondents) about other potentially affected formal and informal groups. The results of this stage may indicate the need to change the number of groups considered and the scope of concerns from those initially anticipated in the qualitative stages of the analysis.

In any event, the questions to be asked, and the points to be covered related to each question should be written down in exactly the form they will be asked in these preliminary interviews. This will insure that all of the issues of interest will be touched on in the discussions in the same sequence. It will also permit an examination of these preliminary questions for possible biases and ambiguities. Finally, the writing out of these preliminary questions will also facilitate the development of a subsequent pilot survey and the formalizing of the survey/interview schedule finally used to collect the data.

The congruence of the two analyses, coupled with a high degree of non-support, might suggest the need to rethink the project, simply dropping it until there is a change in public views, or the need to pursue a program to educate the area on the need for the project. In most instances however, there will be some discrepancies between the qualitative analysis and the preliminary interviews, and thus a need to collect more conclusive information.

At this point, issues of interest should be worked up into a series of open-ended and/or closed-ended questions as needed. The formulation of the questions (wording and conceptualization of the issues) for each of the groups of direct participants and the affected groups of citizens should be based on the findings of the initial discussions with a representative from each of the various directly involved and/or affected groups.

At this point, the water resource manager will have a good idea of the scope of the information gathering phase of the QSA preparation. It is at this point that the decision should be made whether to collect the data internally or to turn any or all of the subsequent phases of questionnaire/survey/interview development, data collection, and data analysis and summary over to professional social science researchers. Certainly, the relative cost of the two options should be carefully considered in conjunction with the precision required of the data.

Open-Ended vs. Closed-Ended Questions. There are advantages and disadvantages to each of these types of questions. The use of open-ended questions, such as those found in interview schedules for direct participants (Appendices B, C, D, H) permits the interview to proceed in a more conversational manner, with a respondent describing his reactions to the project in his own terms. The use of open-ended questions also enables the interviewer to obtain a more complete picture of the nature and basis of a group's or individual's views and makes it easier to determine how alternative projects might be received. The very factors, however, which let open-ended questions produce a more natural interview also contribute to the difficulties in comparing the information about various groups' risk, cost, and benefit perceptions for a particular project. There may also be a problem of obtaining complete information when an open-ended interview is used. It is easy to overlook one or two points in the course of one-hour discussion, particularly if the discussion is not highly structured.

A major advantage of closed-ended questions is that responses may be easily compared across various groups of respondents. The use of such a highly structured format insures that all individuals have an opportunity to respond to the same set of issues. Another advantage of closed-ended questions is that responses to them are more easily coded with less possibility of bias (or error) than responses to open-ended questions on the same topic. These advantages stem from the same factors which also contribute to the limitations of these types of questions: they may yield false precision or force respondents into opinions they do not hold. For example, consider a question which asks, "Which of the following hazardous substances may, at this time, be present in your drinking water?"
(Check all that apply).
___heavy metals
___pesticides
___chemical wastes, etc.
versus a two part question which asks, "Do you believe that any hazardous substances could find their way into your drinking water supply at this time?" __yes __no
(If the respondent said "no" skip to question number __) If yes, What kinds of potentially hazardous materials?
(Check all that the respondent volunteers).
___heavy metals
___pesticides
___chemical wastes
___bacterial contaminants
___viral contaminants
___other (specify)
The use of the first form of this question will produce results suggesting that nearly everyone is concerned about one or more toxic substances potentially present at this time in their drinking water supply. The second form of the question will produce a different and more accurate view of these concerns. Both forms categorize the potential hazards in a way that may be different from that used by the respondent himself. Indeed, because of such problems, it is imperative that the preliminary version of any questionnaire, open or closed-ended, be pilot tested on a small group of respondents in the case of the affected

groups and two to four respondents typifying the direct participants.

As suggested by the nature of sample survey and interview schedules contained in Appendices B through H, it is frequently desirable to use a combination of open-ended and closed-ended questions for the interviews with the direct participants and primarily closed-ended questions in assessing the perceptions of the members of various affected but not directly involved groups. As a general rule of thumb, the broader the scope of the project, and the less previous data which can be related to the proposed project, the greater the need to rely on structured open-ended questions coupled with detailed probes to insure completeness of responses. The greater the degree of past experience which can be related to the present project and/or the narrower the scope of impacts, the more that closed-ended questions, such as those in the citizen interview forms and the Herbicide Orange Direct Participant Interview Schedule (see Appendices E, F, G, and C respectively), can be relied upon.

Finally, the survey used should provide for obtaining some basic demographic information from the respondents. A thorough discussion of the mechanics of question development and the trade offs involved in open and closed-ended questions as well as sampling and other relevant considerations may be found in A.N. Oppenheim Questionnaire Design and Attitude Measurement. New York: Basic Books, 1966. Any water resource manager who is going to attempt to do all the interviewing and surveying in-house should make sure that the staff involved are thoroughly familiar with the issues covered in this book or a comparable volume before proceeding. Even so, the initial efforts will probably yield as much learning about the pitfalls of survey research as about the cost/risk/benefit perceptions of the proposed innovation.

How to Survey. Prior to beginning the pilot survey, a decision must be made concerning the form of survey to be used in collecting data from the directly affected groups and the direct participants in the decision process. Three common methods of obtaining the data are: mail questionnaires, telephone interviews, and face-to-face interviews. There are a number of advantages and disadvantages associated with each of these techniques. Generally speaking, personal interviews (face-to-face or telephone) are desirable when dealing with direct participants. Ambiguities and incomplete responses are much easier to correct in direct exchange than by mail.

Despite their advantages, face-to-face interviews are susceptible to a number of biasing factors. The age, sex, race, manner of dress, general appearance, and other personal characteristics of the interviewer have been shown to affect the answers obtained from a respondent, when the respondent differs markedly from the interviewer on such characteristics. There appears to be less bias in obtaining information from direct participants than from affected groups (citizens). One reason which might account for this difference is that direct participants are being interviewed in their public role or official capacity, while the members of affected groups are being interviewed for their personal views, in their homes.

Telephone surveys have many of the advantages of face-to-face interviews while not being susceptible to most of the factors which can bias the face-to-face interview. A major disadvantage of telephone interviews is the difficulty in explaining many alternatives (or lengthy alternatives) to closed-ended questions. In the case of direct participants, this problem may be overcome by scheduling a telephone interview and mailing the respondent a copy of the interview schedule before the interview is conducted.

Telephone surveys are also well suited for obtaining information from members of affected groups. In most instances, the necessary demographic information and their risk, cost, and benefit perceptions may be easily obtained within the space of a 10-12 minute interview. Response rates to telephone surveys tend to be quite high (80-90% for commercial surveys) and they yield the information more rapidly than any other form of survey. The major disadvantage is that the response alternatives must be kept quite simple. Also, much of the calling should be done after 6:00 in the evening and on weekends to ensure an equal likelihood of obtaining male and female respondents. (Calls made to homes between 8:00 a.m. and 5:00 p.m. during the week are more likely to yield female respondents who work in the home, a potentially biased sample).

Finally, mailed questionnaires have some merits and serious limitations. In particular, mailed questionnaires are relatively inexpensive, require little skill to administer, and can be administered simultaneously to large numbers of people. Mailing permits wider distribution and offers less chance of distribution bias. Neighborhood (face-to-face interviewers often "miss" a disproportionately large number of interviews with persons living in "undesirable" areas), type of family (lower class and upper class are difficult to obtain face-to-face interviews with) and other characteristics (e.g. works night shift) are not problems with the mailed questionnaire. The mailed questionnaire provides a stardardized order and delivery of questions. It can provide the respondents with a high degree of confidence of anonymity. Thus, it may be useful for sensitive or highly controversial topics.

The major disadvantages of a mailed questionnaire are that it requires respondents with at least a minimal level of literacy and is relatively inflexible. You can't make sure that the respondent understands the question, and you can't probe weak, interesting, contradictory, or omitted responses. It is inappropriate for complex material, or when special explanations are necessary. Finally, a mailed questionnaire may be too long. The return rate for mailed questionnaires falls off sharply when their length exceeds 6 to 8 pages.

Appendix B is an interview schedule which was used in face-to-face interviews with direct participants in obtaining data for the water case study. Appendix H is a mailed questionnaire which was used to obtain parallel information from direct participants who could not be directly interviewed. And, Appendix E is the telephone interview schedule used to obtain parallel data from the affected groups of citizens in this study. Appendices C and G are the telephone interview schedules which were used to obtain parallel information from direct participants and affected groups of citizens in the Herbicide Orange case study. Comparisons of the forms of questions used in each instance provide an indication of the limitations and advantages of each of these approaches.

In general, the time limitations for conducting a QSA coupled with the need for only limited information from groups of affected citizens will, for most innovations of small and moderate scale impact, make telephone surveys the method of choice for obtaining data on risk, cost, and benefit perceptions from these groups. For the same reason, face-to-face or open-ended telephone interviews will be the usual method of choice for obtaining the risk, cost, and benefit perceptions of the direct participants. In the case of large scale projects affecting persons in a wide geographic area, mailed surveys may become a more cost-effective alternative for gathering data on affected citizens' views. The need for a full explication of the views of most direct participants makes it unlikely that any method other than face-to-face or telephone interviews would yield satisfactory data on their perceptions of the risks, costs, and benefits arising from a proposed innovation.

The Pilot Study. As indicated previously, it is mandatory to conduct a small scale pilot study at this point. For the direct decision participants the respondents should be two to four persons who typify (in so far as possible) the direct participants. In the case of the affected groups a small sample should be drawn from the population(s) of interest, using the same sampling procedures which will be used to draw the sample for the actual data collection. (A set of procedures which will yield a satisfactory approximation to a simple random sample will be outlined in the following section.) The pilot sample for a telephone survey may consist of 20-30 respondents. For surveys conducted by mail, it may be necessary to mail out 50-70 surveys.

There are a number of purposes in conducting such a pilot survey. In the case of mail surveys, it will permit a check on the quality of the mailing lists. You may find that the list is outdated, or contains units it is not supposed to contain. It will also allow a check on the rate of return. Return rates on most well-conducted mail surveys should approximate 70-90% after one follow up (i.e. a reminder letter with another copy of the questionnaire). Approximately 90-95% of initial responses to a mail questionnaire should be in at the end of 14 days. Finally, the pilot study for a mail survey permits an assessment of the effectiveness of different layouts, titles, and introductory letters.

In the case of telephone surveys, the pilot study gives an indication of the probable response rate and the amount of time that it will take to administer the survey. It will permit a check for bias of all possible sorts. The adequacy of the introduction and of the wording of questions should also be checked during the pilot. Particular attention should be given to assessing how well the questions and answers are understood. In phone surveys, respondents should be encouraged to request clarification of all items not understood, at the outset and at regular intervals throughout the course of the survey. In mailed questionnaires, respondents might be asked to "underline those words or phrases whose meanings aren't clear", or "_________which are confusing." Attention should also be given to determining the completeness of the alternatives and the exclusiveness of categories for closed-ended questions. And, some attempt should be made to determine the extent to which parallel questions are producing comparable data across groups.

Finally, the data from the pilot study should be used to determine the usefulness of the data obtained from the survey. There should be an attempt made to conduct the intended analyses on the pilot data. This procedure may reveal numerous unanticipated problems, e.g. ambiguities in the meaning of particular patterns of responses. The presence of such difficulties may suggest alternative wordings or additional clarifying questions necessary to interpret responses of interest. In the same manner, an effective pilot study may suggest where it is possible to develop closed-ended questions as alternatives to open-ended questions used in the pilot study.

A pilot survey should always be conducted. It is obvious that pilot studies can guide the researcher and considerably improve the quality of the research. It may not be so obvious pilot studies may also save money. A pilot survey may prove the percentage of returns to be higher than expected and that therefore a smaller number of questionnaires can be mailed. Or, it may prove that the survey cannot possibly produce the desired results (either quantitatively or qualitatively), in which case the forewarned researchers will have saved the lion's share of the budget allocation by _not_ doing the rest of the survey at this time or in this fashion.

At the conclusion of the pilot study, and an examination of the pilot data, the codebook for direct participants and affected citizens should be carefully finalized. (Three to four hours spent at this point can save several hundred man hours in attempting to code data from open-ended questions, or multiple responses to closed-ended questions.) Appendices I and J are preliminary and final codebooks for the drinking water case study. As can be seen from these two appendices, the codebook is simply an indication of how any response to each of the questions will be recorded in machine-readable form for subsequent analyses. The primary factor to keep in mind is the necessity of having exhaustive _and_ mutually exclusive categories defined for the coding of responses. This will make the actual data much easier to code, and will remove the unreliability of coder judgement over time as a source of error in the data.

Conducting the Actual Survey. At this point, the preparer of the QSA is ready to approach the direct decision participants to collect their views on the proposed project, and to gather the views of a random sample of affected citizens. The direct participants should initially be approached by letter or phone, the purposes of the survey explained, and a time for the "formal" interview arranged. If necessary, provide the potential respondent with a copy of the interview schedule to look over ahead of time. This will permit him to pull together any information he might need to respond accurately to the survey, and will permit the actual interview to proceed in a more rapid and more organized manner.

When conducting the interview with the direct decision participants, tape record the entire interview, when permitted, in addition to making notes on the responses to questions. Such tape recordings provide an invaluable check on the accuracy of notes taken (separating actual statements from your surmises and summaries). The permission to tape record the interview should always be obtained well in advance of the actual interview. And, under no circumstances would respondents' answers be tape recorded without their expressed permission. Finally, the interview should attempt to code the responses to the questions as the interview proceeds. This will indicate all points at which further explication by the respondent is needed to produce a usable response and will greatly speed subsequent data analyses.

In the event that a direct participant is reluctant to respond to a particular question, a reminder by the interviewer that these data are being used for _planning_ purposes, hopefully to head off potential conflicts; and stressing the importance of obtaining input from all sides on such projects early in the planning phase, should produce a codeable response. In the event that the respondent still declines to provide the requested information, the interviewer should respect his views and proceed to the next question. When the interview is finished, the interviewer should ask if there is anything else that the respondent wishes to add or any points he would like to clarify further. The interviewer should then take a moment to make sure that the information is complete and coded and then terminate the interview. At this point, the interviewer should avoid the temptation to respond to questions from the respondent about how opinions are running on the proposed project. Subjective impressions based on incomplete data are typically (in accordance with Murphy's Law) wrong and if verbalized too soon, regretted later. The next step in conducting the actual survey is to draw a random sample representative of affected groups of citizens. (An outline of the procedures which may be used to develop a sample is presented in the immediately following section). Once the sample is drawn, the individuals should be contacted and the survey administered. A mailed questionnaire should be accompanied by an introductory letter on your office's official stationary. This letter should briefly outline the purposes of the survey, and stress the importance of their (citizens) input into the initial planning stages of the proposed project. Two weeks after the initial questionnaire was mailed out, a reminder should be sent to all individuals who have not responded to the initial questionnaire. If the response to the initial and follow-up mailing is sufficient, analyses of the data may then be initialed. If the response has not been adequate, it may be necessary to draw another random sample and send out another round of questionnaires.

If telephone interviews are being used, interviewers may proceed to contact the desired party at each phone number, and when permitted, to interview them. Each telephone contact should begin with a brief introduction which identifies the interviewer, states in a few words the purpose of the interview, stresses the importance of their participation, indicates approximately the length of time the interview will take, and then asks permission to proceed with the interview. (A sample introduction along with the explicit instructions to the interviewers used in the water case study are contained in Appendix K). If the respondent declines to participate at this time, an effort should be made to schedule a more convenient time for the interview. If the potential respondent declines to participate, he/she should be thanked for the time and the contact terminated. If the potential respondent agrees to participate, the interviewer may proceed, reading the questions carefully, and taking care to accurately record the respondent's answers. At the end of the interview, the respondent should be thanked for participating and the contact terminated.

In all cases, the data from affected groups should be coded in preparation for analysis as it is being collected. Although it is another thing to be done, it saves a great deal of time in the long run.

The Drawing of a Random Sample from Affected Groups of Citizens. There are a number of alternative sampling procedures which may be used in the conduct of surveys. A number of these are described in A.N. Oppenheim Questionnaire Design and Measurement cited earlier. In most instances, however, an approximation to a simple random sample is quite adequate (and indeed is frequently most appropriate) for the preparation of a QSA. There are a number of potential sources of names, addresses, and phone numbers for members of affected groups of citizens. These include phone directories, lists of power company customers, voter registration lists, water company customer lists, and municipal directories.

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Each of these sources has some limitations. For most purposes in the development of a QSA, however, phone directories will provide an adequate approximation to the population of interest.

In drawing any sample the object is randomness-that is, every adult in the population from which the sample is drawn has an equal chance of being included in the sample. The ideal situation is to have a list of names, addresses and telephone numbers which included all those who are in the pertinent population and none who are not in the population. (Such a list is, unfortunately, rarely obtainable in practice.) For the study of safe drinking water, the pertinent populations were the customers of the water suppliers in the three communities studied. An up-to-date list of customers of each of the three water supply companies would closely approximate the "ideal" list of the appropriate populations. When the surveys were conducted these ideal lists were not made available and appropriate telephone directories were used instead.

The first step in using telephone directories is to determine as accurately as possible which telephone exchanges (that is, roughly which geographic areas covered by the directory) should be considered to be part of the population and which should not. For example, water service may stop at municipal boundaries, while the directory includes suburban exchanges. If some exchanges are to be eliminated, you will need to over sample (select more names than the sample size you are aiming for), so that the inappropriate names and exchanges can be ignored when encountered.

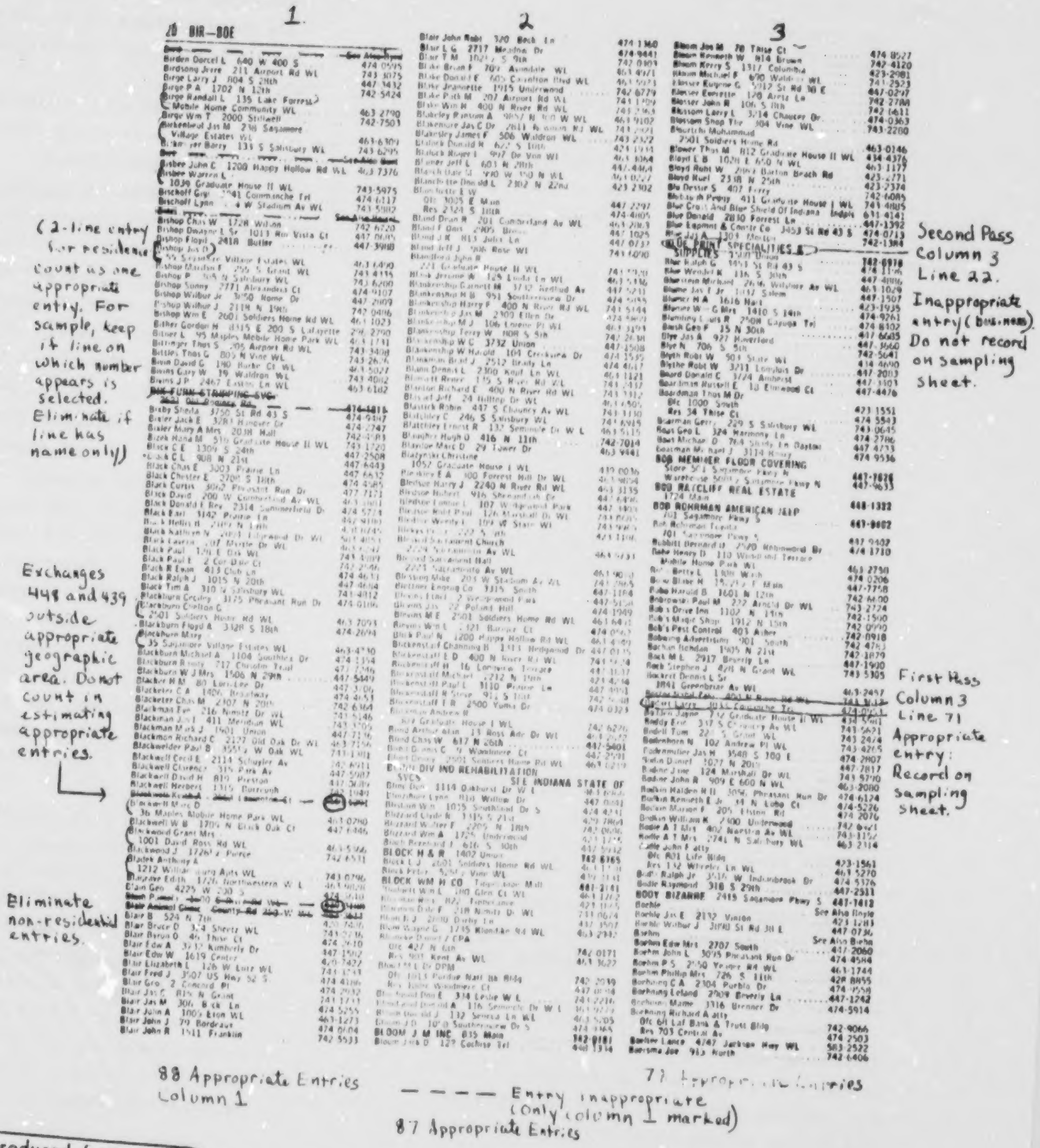
In order to draw the sample, first determine two numbers: (1) the approximate mumber of appropriate entries on the list and (2) the desired size of the sample. The second number, the sample size, is a matter of judgement and has been discussed earlier. To determine the number of appropriate entries, a succession of steps is necessary:

1. Count the number of pages in the directory which actually list telephone numbers (i.e., discounting yellow pages, instructions and so on).
2. Count the number of columns per page. On the attached sample page there are three columns.
3. Count the number of appropriate entries in each of several columns selected at random. Notice that only residential entries with appropriate exchanges should be included in the count. Businesses, double line entries, and telephone exchanges which are not part of the appropriate population considerably reduce the number of appropriate entries in some columns. In the attached example, the telephone exchanges 448 and 439 have been eliminated. In column one, the lines considered not appropriate to the count have been lined out and the total of appropriate entries noted at the bottom of the page. The average (mean) of the totals of several columns counted in this way is the number of entries per column.

Suppose that the directory from which the sample is going to be drawn has 152 appropriate pages, 3 columns per page, and an average of 90 appropriate entries per column. The size of the population is then 152x3x90=41,040.

order to allow for eliminating selections (deleted exchanges, businesses), the number used in calculation should be larger than

Example of Sampling from Telephone Directory


1
2
3
20 BIR—BOE

(2-line entry for residence count as one appropriate entry. For sample, keep if line on which number appears is selected. Eliminate if line has name only)

Exchanges 448 and 439 outside appropriate geographic area. Do not count in estimating appropriate entries.

Eliminate non-residential entries.

Second Pass Column 3 Line 22. Inappropriate entry (business). Do not record on sampling sheet.

First Pass Column 3 Line 71 Appropriate entry: Record on Sampling Sheet.

88 Appropriate Entries Column 1

87 Appropriate Entries

77 Appropriate Entries

— — — Entry inappropriate (Only column 1 marked)

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the desired sample size. Suppose the desired sample size is 150. Since there are 152 pages in the book, one might think that one number per page would be sufficient. But to preserve randomness, we cannot eliminate one number on a page and select another. A figure of 200, or more than one number per page, is a safer one on which to base sample selection.

To get 200 entries, one entry on each page on a first pass through (152), plus one entry on every third page (152/3 ≈ 51) on a second pass through the directory will be needed (152 + 51 = 203) to reach the intentionally overestimated sample size. If the sample has not reached well over 150 by the time the process is complete, a third pass through the directory may be necessary.

It is essential to preserve randomness in determining which number or numbers to select from each page. The simplest system is to select a column at random (write 1, 2, 3 on separate pieces of paper and literally "draw from a hat") a column number. Then, using a table of random numbers or the "draw from the hat" system, draw a number between 1 and 90 (number of entries = 90 entries per column) to determine the exact entry to be selected in that column. In the example attached, this process was used for each of the two passes through the directory.

Pass 1:
- each page
- column 3
- line 71

Pass 2:
- every third page
- begin on page 2 (like selecting a column, the beginning page is selected randomly)
- column 3 (notice that all columns are put back into the hat to select for the second pass)
- line 22

Though the process seems tedious, it is accurate and random. As each entry is selected, it is recorded on a sample sheet, similar to that in Appendix L, ready to be used for conducting the survey.

Analysis and interpretation of the data. Whatever analyses are undertaken, it should be kept in mind that the purpose of the QSA is to provide an empirically based picture of the perceptions of risk, cost, and benefit associated with a proposed project held by persons directly involved in the decision process, and other persons potentially affected. The analysis outlined in the Drinking Water Case study (Appendix M) illustrates a simple approach to the problem of analysis, while that outlined in the Bailly Power Plant Siting Case Study illustrates a more sophisticated approach (Appendix A). The level of analysis is best determined by the questions which the water resource manager needs to answer. At the simplest level, the water resource manager who is proposing a project needs to know what is the sum total of risks, costs, and benefits which each of these groups of direct participants and affected groups of citizens sees as accruing from the proposed project. He or she further needs to know which subsets of these risks, costs, and benefits are most important to the particular groups of direct participants and affected citizens. This will provide a picture of the extent to which the various groups share particular concerns, where majority sentiment is on these issues, points of agreement and disagreement among direct participants and affected citizens, and perhaps most important, an idea of the scope of concerns which must be treated to make the technical project widely accepted and supported. Beyond this, it may be necessary to consider differences in perceived likelihood and the relative desirability/undesirability which various groups attach to particular risks, costs, and benefits to explicate the bases of differences among various groups' positions. In many instances these data may be obtained from the examination of a set of tables such as Table 3 in which the entire set of anticipated risks, costs, and benefits are listed along the top of the table; the various groups (including the water resource manager) are listed down the left hand margin, and the cell entries consist of the mean ratings of importance, perceived likelihood, and relative desirability/undesirability in the three tables respectively. Beyond this, analysis of variance techniques may be used to determine the extent to which various groups exhibit statistically significant mean differences in their positions on particular issues, and the extent to which particular issues are more or less important to a particular group. (c.f., the Bailly study by Castore & Nicholson, Appendix A). The critical point here is simply that the analysis should be sufficient to answer the initial questions. The simpler the analyses are kept, the easier the results are to understand and translate into some course of action.

Results of a QSA and the Water Resource Manager

If there is strong support for the proposed project, and there is essential agreement on the nature and relative importance of the anticipated risks, costs, and benefits, then the water resource manager may simply proceed with the project and file the QSA on the shelf for future reference. More often, however, something less than this ideal state is found. For example, in the water case study mixed agency support was found for the implementation of more stringent testing schedules. There was little, if any, public awareness of the need for such procedures. Such circumstances are a clear indication of the need for adequate information campaigns to acquaint the public and the personnel of some local agencies with the needs for such a change and a better picture of the risk, cost, and benefit considerations involved. There is a growing body of data to indicate that the public is quite willing to pay for necessary improvements and/or innovations to the extent that they are seen as truly necessary (Bajgier and Moskowitz, 1978; LaPorte and Metlay, 1975; Slovic, et al., 1976).

Even in those instances when there is clear majority support for a project, the data may reveal that the majority are basing their acceptance on misinformation or noninformation. This should be a spur to generate some type of public information campaign. Otherwise, future necessary projects will become increasingly difficult to find support and funds for.

In those instances when there is not sufficient support, or perhaps strong opposition, the water resource manager must rethink the proposed project. The data should be examined to determine if there is an alternative project which is equally acceptable from the technical perspective but more viable politically. If not, it may be necessary to shelve the project and initiate an information campaign to acquaint objecting groups with the needs in the situation and the options available to them. Then perhaps at a future time, the proposed project will be acceptable to a better informed public.

Finally, an examination of the concerns of the various affected groups and direct participants may suggest some manner of compensating those groups who see themselves as potential losers if the project is initiated. This may be an equally effective manner of forestalling costly delays and litigation.

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APPENDIX A.

CASE STUDY ON BAILLY NUCLEAR POWER PLANT

Nuclear Technology, Public Values and Public Policy

How citizens and decision makers view the cost and
benefits of the Bailly, In. nuclear power plant.

Carl H. Castore and Heather Johnston Nicholson October 6, 1977

From the early 1800's till the mid 1950's it was generally assumed that what was good for business and industry was good for the country (1). The thought was that to the extent there was a firm base of industry in a locality, there would be jobs, increased revenues from individual and corporate taxes, and increased business for the merchants and tradesmen in the area. During much of this period a certain amount of environmental pollution was taken as the natural and inevitable cost of growth and development--the wages of civilization. During the early phases of industrial development in this country, the costs, risks, and benefits of this approach to industrialization were confined to local communities or at most clearly defined regions within a state. Thus, the choices and trade-offs were being made, in one sense, on a local level. In the current vernacular, a cost-benefit analysis of such industrial siting decisions would almost invariably have found that the perceived benefits in each instance far exceeded the costs in an area. By the second quarter of the 20th century this state of affairs had begun to change; and by the mid 1950's industrial development *per se* was no longer being universally accepted as a highly desirable community goal. Many communities no longer saw growth *per se* as a desirable way to augment their quality of life. Further, and perhaps more importantly, the risks, costs and benefits associated with such endeavors were becoming less and less equitably distributed (2, 3).

The processes generally involved in the siting of a nuclear power plant provide a prototypic example of the operation of the conflicts engendered by these changing community values. The traditional cost-benefit analysis used by power companies in this instance weighs the benefits (as they see them) from additional low-cost power, more jobs, greater tax base for the community; against the risks-cost (as they see them) of probabilities of release of thermal and nuclear pollutants, displacement of present owners of the land, detriment to the esthetic and sporting value of the site, etc. A positive siting decision (by a power company) is always based on a favorable risk-cost/benefit ratio being found. Thus, the officials of a power company may see themselves as benefactors who have been more than accommodating to the needs and preferences of the citizens of a community.

However, the view from the perspective of citizens in the potentially affected communities may reflect a different set of notions of the costs and benefits accruing from the project. Much of the electricity may go to neighboring states. An expanded tax base and additional jobs may pose a direct threat to the community's efforts to achieve a limited-growth, pleasant residential community. The company personnel may live in the next county or next state and so will not be exposed to even the small, but still non-zero chance of a reactor core meltdown. Thus, the citizens may (rationally) see themselves as bearing virtually all of the risks-costs while reaping few, if any, of the benefits of the nuclear power plant.

The outcome under these conditions (with each party holding equally rational but apparently irreconcilable positions) is likely to be stalemate and growing animosity. The power company will typically continue its efforts at licensing and plant construction, often at substantial cost. Similarly, intensely interested citizens of the community and region will typically unite to attempt to thwart these efforts, also at a substantial cost. For example, it is estimated that the six-year delay in obtaining a final licensing decision for Bailly Nuclear Power Plant--the context of the present study--has cost Northern Indiana Public Service Company (NIPSCO) $12.7 million in legal fees, technical studies, etc. associated with the defense of their plans. This figure does not include intangible costs such as opportunity costs nor the more than $60 million invested in preconstruction planning and associated research. The cost to the various groups who have opposed the project on a variety of grounds are estimated to be at least equal to the $12.7 million spent by NIPSCO in defense of their plans. Thus, in this instance a six-year battle in courts and hearings by various regulatory agencies has cost approximately $25.4 million either directly or indirectly. The monetary costs and community divisiveness arising from such a legal "holding pattern" are but two of the more prominent unanticipated and largely unintended outcomes typical of such conflict situations. Such outcomes are by and large counter to the interests of the affected region or community as a whole and the corporation involved. Certainly a speedier, less emotional resolution process than the adjudicative-adversary process typically used could have allowed for the alternative expenditure of some portion of the $12.7 million spent to date by NIPSCO in pursuit of licensing in a manner that might have alleviated much of the perceived inequitable distribution of risks, costs, and benefits associated with the project.

The present study was a comparative examination of perceptions of the risks, costs, and benefits held by the individuals directly involved on both sides of the controversy surrounding the siting of Bailly nuclear power plant in northern Indiana; and the perceptions of risks, costs, and benefits held by the residents within a 30-mile radius of the proposed plant site. Such an examination permits a precise definition of the areas of actual concern and a quantification of the degree of conflict in the situation. At the same time, it could also define the necessary characteristics of any set of equitable solutions or define what aspects of the various parties' postitions would have to be altered before an equitable outcome could be reached.

Method

The process involved in the siting of the proposed Bailly nuclear power plant outside Bailly, Indiana, was selected for this study because it appeared in many respects to be a prototype of such controversies. At the time the study was conducted, it was one of the longer standing unresolved nuclear power plant siting controversies in the United States--6 years in duration. The groups and issues involved were clearly defined and reflected a broad range of the types of arguments (both pro and con) and groups which emerge in such circumstances.

Subjects. On the basis of records of proceedings before the Atomic Safety and Licensing Board, the U.S. Court of Appeals for the Seventh Circuit, and the U.S. Supreme Courts, seven groups were identified as having had either a direct or an indirect impact on the Bailly decision. These groups are indicated in Table 1.

A total of thirteen persons, including at least one from each group directly involved in the decision process, were interviewed to obtain information on their groups' perceptions of the risks, costs, and benefits stemming from the proposed Bailly nuclear power plant. Two random samples of 155 persons each were drawn from area phone books to provide a proximal sample of residents living within 15 miles of the proposed plant site, and a distal sample of residents living between 15 and 30 miles from the proposed site.

While neither group of citizens had been directly involved in either the regulatory hearings or subsequent adjudicative procedures, many of the arguments made by direct participants were couched in terms of the anticipated impact of the project, or lack thereof, on these two groups of citizens.

Structured telephone interviews of 10-15 minutes each were completed with 119 members of the proximal sample and 123 members of the distal sample. A subsequent comparison of the age, education, income, home ownership, and political party preference data from these two samples against 1970 census data and voting records for this area indicated that these two samples did not differ significantly from their respective populations.

Perceptions of risk, cost, and benefit. Direct participants and citizens were asked parallel sets of questions to establish their positions on the issues as related to the proposed Bailly plant. In these questions respondents were asked to indicate their perceptions of the relative desirability, likelihood, and importance of several possible consequences of constructing and operating the proposed Bailly plant. The questions, as posed to direct participants and citizens, are presented in Table 2.

In responding to the open-ended questions, all of the direct participants in the decision were quite willing to discuss the positive and negative aspects of the proposed plant, as their group saw it, and in general terms to indicate which of these factors had most influenced their group's position. All participants were also willing to discuss and comment, in a general fashion, on the likelihood, desirability and importance in shaping their group's position of the twelve possible outcomes summarized in the structured rating task. However, several of the direct participants declined to provide quantifiable ratings of either their personal position or their group's position on some or all of the twelve outcomes noted in the questionnaire and any additional consequences they had mentioned earlier in the interviews

To provide the quantitative data necessary for the comparative analysis of the views of direct participants and citizens, a group of nine judges read the transcript of each direct participant's interview. They then independently rated the twelve stated possible outcomes as well as any others the respondent had volunteered in terms of how that group appeared to see their relative likelihood, their desirability, and their importance in shaping the group's position on the plant. The judges were all professionals in the areas of political science, economics, psychology, civil engineering, and nuclear engineering. Interjudge agreement on these rankings (assessed in terms of Kendall's coefficient of concordance - W) across the outcomes considered for all thirteen interviews ranged from W = .76 to W = .93, with a median value of W = .87.

Results

The proximal and distal samples were each divided into four subgroups: (a) citizens who were in favor of the general use of nuclear technology to meet energy needs, and in favor of the construction of the Bailly plant; (b) citizens in favor of the use of nuclear technology, undecided about Bailly; (c) citizens in favor of the use of nuclear technology, against the construction of Bailly; and (d) citizens against the use of nuclear technology, and against the construction of the Bailly plant. The numbers of these subgroups are indicated in Table 3.

To facilitate the analysis and direct comparison of citizen and decision participant perceptions across the entire set of potential outcomes it was necessary to combine certain of the ten potential negative consequences evidenced in the direct participants' interviews so as to provide five categories of potential positive consequences and six categories of potential negative consequences, eight of which directly paralleled the eight categories of outcomes appearing in all the citizen interviews. The remaining three categories were outcomes occasionally mentioned by the citizens (clean reliable source of energy, interference with park management, negative impact on the visual landscape); but such references occurred too infrequently to permit their inclusion in the analyses. The data for the subjects' ratings of desirability, likelihood, and importance were analyzed in separate analyses of variance for each of the possible outcomes considered. (The structure of the data is essentially multivariate in nature. However, the analysis problems posed by the widely varying number of persons within a group who were familiar with, and rated the possible outcomes precluded the use of more elaborate multivariate analysis procedures). The significance of differences between the mean ratings for the various groups on each of the potential consequences were assessed by means of Newman-Keuls procedures (4).

The mean ratings by each group of the desirability, likelihood, and importance of each outcome are indicated in Tables 3, 4, and 5 respectively. The F-ratios and degrees of freedom for each analysis are included at the bottom of each table. Cell means within a column which do not share a common subscript are significantly different at the $p < .01$ level.

Discussion

Citizen ratings. When one considers the number of persons who volunteered or were familiar with possible outcomes, the three potential outcomes of concern to most citizens were (1) the availability of sufficient electricity (79.0%), possible pollution (78.5%), and some form of radiation hazard (83%). Somewhat fewer citizens were familiar with the other potential positive consequences of more jobs in the area (62%), more business in the area (56%), and a slower rate of increase in electricity costs (43.5%). Still fewer citizens were aware of possible disturbances during construction (23%), or the possibility that the plant would attract too much additional industry to the area (24%), as potential negative outcomes from building the plant.

Desirability of Outcomes. Table 3 presents the mean ratings of the citizens and direct participants on the desirability of positive outcomes and the undesirability of negative outcomes potentially accruing from the Bailly plant. Citizens agreed among themselves that sufficient electricity and slower rates of increase in electric bills would be desirable outcomes. They shared this position with the direct participants, with the notable exception of the Joint Intervenors.

Citizens generally saw more jobs in the area as desirable. The two groups most enthusiastic about more jobs were in the proximal sample: those who favored both nuclear power and the plant and those who favored nuclear power but were undecided about the plant. Most citizens' groups gave a higher rating to the desirability of more jobs than did the direct participants. More business in the area was a desirable outcome for citizens, with the exception of the small number who rated that outcome negatively in pro-nuclear, anti-Bailly group in the proximal sample. Though small variance in some cells precluded statistical generalization, the citizens' high rating for desirability of more business in the area came close to that of NIPSCO, the company proposing the plant. In general, the citizens were at least as optimistic about the potential positive outcomes of building the Bailly power plant as were the proponents of the plant among the direct participants. Even citizens opposed both to nuclear power and to the Bailly plant considered the potential positive outcomes to be desirable.

Pollution as a potential negative outcome of the plant was considered strongly undesirable by citizens generally, and particularly by those opposed to the plant in the proximal and distal samples. None of the groups gave quite so strong an undesirable rating as the Joint Intervenors nor quite so weak a rating of undesirability as NIPSCO.

The possibility of radiation leakage was also condidered quite undesirable by citizens. As with ratings on pollution, the means for groups of citizens generally fell between the high negative ratings of the Joint Intervenors and the Department of the Interior and the lower negative ratings of the EPA, NIPSCO, and the Nuclear Regulatory Commission.

Fewer than one-fourth of the citizens rated disturbances during construction or too much industry in the area as possible consequences of the Bailly plant. For those who did, these were considered moderately to highly undesirable outcomes, as they were for direct participants except NIPSCO.

Where there are consistent differences among groups of citizens on the desirability and undesirability of outcomes, those in favor of nuclear power and the Bailly plant attached higher positive values to the positive outcomes; and those opposed to nuclear power and the plant attached higher negative values to the negative outcomes. Taken together, the citizens were at least as enthusiastic about the positive outcomes as NIPSCO and only slightly less vehement about the negative outcomes than the direct participants opposed to the plant.

Likelihood of Outcomes. Table 4 represents the ratings of the likelihood that the positive and negative consequences attributed to the Bailly plant would occur if the plant were built.

Sufficient electricity was seen as quite a likely outcome by all groups of citizens. The pro-nuclear, pro-Bailly groups of citizens shared with NIPSCO a somewhat higher estimate of the likelihood of sufficient electricity. Other citizens shared their slightly lower estimate with the Joint Intervenors and the Nuclear Regulatory Commission. The Department of Interior and EPA rated sufficient electricity somewhat lower in likelihood than did the citizens and the other direct participants.

For all groups of citizens the mean probability of a slower rate of increase in electric bills was lower than the probability of sufficient electricity. Nevertheless, a slower rate of increase was considered quite a likely outcome by those citizens who mentioned it. For six of the eight groups of citizens the estimates fell between the low values of the Joint Intervenors and the Department of the Interior and the higher likelihood seen by NRC.

Except for those opposed to the plant in the distal sample, citizens considered more jobs in the area to be a more likely consequence than did the direct participants. Those citizens who favored the Bailly plant assigned especially high probabilities to more jobs in the area as an outcome. The mean values of all but one of the groups of citizens who rated the likelihood that more business would enter the area were higher than the equivalent values for direct participants. As with the issue of more jobs, the Nuclear Regulatory Commission assigned the greatest probability among direct participants and thus came closest to the citizens' perceptions.

Three groups of citizens opposed to the Bailly plant and two groups of direct participants, the Joint Intervenors and the Department of Interior, assigned a higher likelihood to some radiation leakage than they did to the main positive consequence, sufficient electricity. The citizens in favor of the plant gave generally lower estimates of the likelihood of some radiation leakage; but none of the groups of citizens gave as low an estimate as did NIPSCO or NRC.

Citizens from both samples who were in favor of the Bailly plant as well as NIPSCO, NRC, and EPA attributed relatively little likelihood to disturbances during construction. Citizens who were opposed to or undecided on Bailly, along with the Joint Intervenors and the Department of Interior, considered disturbances during construction to be a likely outcome.

Too much industry in the area was considered to be a moderately to quite likely consequence of the Bailly plant. Citizens opposed to the plant gave the highest estimates of likelihood; and citizens in favor of the plant and most of the direct participants assigned most of the moderate likelihoods to this consequence. None of the groups of citizens gave as low an estimate as did NIPSCO of the likelihood of attracting too much industry.

The pattern for the likelihood of consequences was similar to the pattern for the desirability and undesirability of consequences: citizens saw all the positive and the two major negative consequences (radiation and pollution) as quite likely to occur if the Bailly nuclear power plant were built. Those citizens opposed to the plant considered the negative consequences more likely to occur; and those in favor of the plant considered the positive consequences more likely to occur.

Importance of Outcomes. The mean values for the importance attached to the various consequences by the different groups are shown in Table 5. For each group, the ratings of the importance attached to outcomes were consistent with those they assigned for desirability and likelihood. On the potential benefits of the Bailly plant, the citizens looked most like the plant's chief proponent, the Northern Indiana Public Service Company. Citizens in favor of nuclear power and the plant equalled or exceeded NIPSCO's estimate of the importance of the positive consequences; and the other groups of citizens rarely departed significantly from NIPSCO's estimates. Judging by the numbers of citizen-respondents who rated the consequences, sufficient electricity and more jobs in the area struck the most responsive chord for citizens.

On the negative consequences of the Bailly plant the citizens attached greatest importance to the possibilities of pollution and some leakage of radiation, whether judged by the mean values assigned or by the number of citizens responding. The citizens' ratings of the importance of the negative consequences look most like those opposed to the plant (the Joint Intervenors and the Department of the Interior), though they are not statistically different from the position of the Nuclear Regulatory Commission.

When the mean values for desirability, likelihood, and importance were considered, the eight groups of citizens appeared to be quite consistent and rational in arriving at their respective positions. As indicated by the frequencies in Table 3 for the various groups of citizens, the result of a referendum among the citizens would be in favor of building the plant. This would hold whether the referendum included only persons living in relative proximity to the site (proximal sample), or also included those persons living somewhat farther away (distal sample). Indeed, in this instance a referendum would be particularly meaningful since the issues of most concern to the citizens were much the same whether they favored or opposed the construction of the plant and whether they lived quite close to the proposed site or farther away. The citizens made clear trade-offs between the potential benefits and the potential costs and risks as they saw them.

The direct decision participants. The mandates of the various agencies directly involved in the Bailly siting controversy placed constraints on the kinds of issues which each might legitimatly raise in proposing or halting the construction of a nuclear power plant. To a considerable extent, the set of values and concerns expressed by the direct participants reflected these constraints.

Northern Indiana Public Service Company initiated the proposal to construct a nuclear power plant at Bailly, Indiana. As a public utility NIPSCO was mandated to provide for anticipated energy needs. The respondents from NIPSCO attached greater importance to providing sufficient electricity and to a slower rate of increase in the cost of electricity than did the other direct participants. Their perceptions of likelihood and probability were consistent with the importance they attached to these two consequences.

NIPSCO respondents shared with the citizens an emphasis on the immediate and long-term economic benefits of the plant in giving relatively high importance to creating more jobs and bringing more business into the area. All of the NIPSCO respondents volunteered the opinion that nuclear power was a relatively clean and reliable source of energy and attached moderate importance to that as a factor in their decision.

NIPSCO respondents attached some importance to possible disturbances during construction and a reduction of scenic beauty. Both factors were seen as somewhat undesirable and moderately likely. In contrast, the direct participants who opposed the plant saw these possible consequences as highly undesirable and quite likely. The moderate importance NIPSCO attached to factors related to construction and scenic beauty may have reflected their being required to address these issues in an environmental impact statement and the fact that these were the primary sets of issues raised in attempts to halt construction of the plant.

Like the citizens, NIPSCO considered pollution and radiation leakage to be the least desirable consequences. Unlike the citizens, NIPSCO considered radiation leakage or pollution to be quite unlikely. Thus, NIPSCO attached relatively little importance to these factors in their decision. These differences suggest that NIPSCO (and NRC) had not effectively communicated their confidence on these issues to the citizens.

The relatively high importance attached by NIPSCO to the economic benefits and the relatively low importance they attached to the potential negative outcomes clearly indicated that for NIPSCO the benefits of the Bailly plant greatly outweighed the perceived risks and costs.

The involvement of the Environmental Protection Agency (EPA) in the decision process was limited. The original design proposed for the plant would have sent cooling water directly from the plant into Lake Michigan. EPA sets standards for thermal discharge into the lake. Thus, EPA's direct involvement and mandated concern ended when they successfully insisted upon a cooling tower to meet standards for thermal pollution. This was reflected in primary importance attached to potential pollution problems in reaching the decision, which the respondent from EPA saw as the least desirable and most likely outcome to accrue from the plant. The potential for radiation leakage, the reduction of scenic beauty, and disturbances during construction were also given some moderate weight in the formulation of EPA's response to the draft environmental impact statement on the Bailly plant. The long and short-term economic impacts of the plant did not enter significantly into their position, although the respondent did view these outcomes as at least moderately likely and moderately desirable. Thus, EPA appeared to have adhered closely to their mandate in developing their position on the Bailly plant, giving primary attention to the potential for environmental pollution. In de-emphasizing the possible economic benefits, EPA's position differed from that of the citizens and NIPSCO. In attaching greater importance to potential pollution and radiation problems, the respondent shared the concern of the citizens and departed considerably from NIPSCO's position. The low importance attached to essentially local economic issues by EPA probably reflects an appropriate concern with national policy.

The Joint Intervenors were concerned primarily with issues of safety, the environment, and aesthetics in their opposition to the Bailly plant. In contrast to the citizens in the area, little concern was evidenced with the economic issues (Table 5). For them the most important factor in forming their position was the potential radiation hazard, followed closely by pollution problems, and a reduction in scenic beauty. Judging from the low rating which they attached to ostensibly positive outcomes, the Joint Intervenors appeared to have been unconvinced that they would realize significant benefits from the plant.

The Joint Intervenors' ratings of likelihood suggest they were not unaware of the arguments for economic benefits arising from the plant. Though they saw sufficient electricity, more jobs in the area, a slower increase in rates, and more business in the area as at least moderately likely, they saw these outcomes as only slightly desirable, or even undesirable.

The Joint Intervenors appear to have been concerned on two levels. First, they were skeptical of nuclear power plants in general. Like the citizens, they emphasized the undesirability and the likelihood of some radiation leakage and pollution. Nuclear power plants do not appear to meet their safety criteria. The political process involved in siting nuclear power plants makes it difficult to raise such general objections. The process defines state-of-the-art technology as an acceptable level of safety. The points of access for opposing groups to raise their objections (Atomic Safety and Licensing Board--ASLB--and Federal Courts) will only hear objections to granting a license to construct or operate particular power plants and not to the use of nuclear power as a national policy.

Thus, the Joint Intervenors had to operate at a second (local) level of concern in their attempts to halt the construction of the Bailly plant, focusing on the risks and costs unique to the proposed site. These concerns were damage to scenic beauty and various other forms of damage to the immediate environment. It was these claims which formed the basis of their appeals to the ASLB and the courts. In their conceptual map of the area the Joint Intervenors placed a major emphasis on the fact that the proposed site was adjacent to a national wetlands and a national lakeshore. This viewpoint, however, was not effectively communicated to other citizens in the area and to NIPSCO. Both of these latter groups apparently saw the Bailly plant site as a logical extension of the existing industrial corridor.

The Joint Intervenors' concerns about the risks of pollution and radiation were shared by the other citizens and by EPA, but not by NIPSCO. Because of the political constraints on the decision process, the Intervenors had to emphasize their environmental and aesthetic concerns, which were not shared by the area citizens and were not controlling for NIPSCO.

The most important consequence for the Department of the Interior's evaluation was the reduction of scenic beauty. This potential aesthetic detriment was considered very undesirable, and as in the case of the Joint Intervenors, the most likely of the consequences to occur. Specifically, the cooling tower, required to meet EPA objections about thermal pollution, would be clearly visible from Cowle's Bog and Indiana Dunes National Lakeshore.

The Department of the Interior also assigned moderately high importance to potential pollution, radiation leakage, and disturbances during construction. They rated radiation leakage as extremely undesirable, and moderately likely; some pollution as quite undesirable, and quite likely; and problems during construction as moderately undesirable and quite likely to occur. In this latter regard, the Joint Intervenors contended, and the Department of the Interior concurred, that one of the virtually unavoidable consequences of preparing the foundation for the plant would be a serious lowering of the water table in the adjacent Cowle's Bog.

The Department of the Interior considered sufficient electricity moderately desirable, and likely to occur (Tables 3 and 4). They considered a slower rate of increase in the cost of electricity the most desirable consequence, but moderately unlikely to occur. More jobs in the area were considered slightly desirable, but moderately unlikely. None of these consequences was considered as likely to occur as the reduction in scenic beauty and pollution. Thus, for the Department of the Interior, as for the Joint Intervenors, and those citizens opposed to the plant, the costs and risks of the plant outweighed the potential benefits.

Paradoxically, interference with the management of the Indiana Dunes National Lakeshore was given low importance ratings by both the Department of the Interior and the Joint Intervenors. These ratings were consistent with their likelihood and desirability ratings. Nonetheless, this was one of the major issues (in terms of delaying construction) raised by Interior and the Intervenors in the court battles against the Bailly plant.

This situation may have arisen because the active participation of the Department of the Interior on the Bailly proposal had been severely limited by the White House's Domestic Council. Thus, they were forced to limit their direct objections to an administrative issue related to the mission of the Department of the Interior while relying on the Joint Intervenors to raise other issues of concern. As in the case of the other direct participants, the pattern of concerns shown by the Department of the Interior was consistent with their mission and with their perceptions of likelihood and desirability of consequences.

A consideration of the importance ratings for the Nuclear Regulatory Commission (NRC) suggests that in reaching their decision to grant the construction permit for Bailly close attention was paid to potential adverse aesthetic impacts, problems arising from construction, possible radiation and pollution problems (although to a lesser extent than groups opposed to the plant), and the benefits accruing from sufficient electricity and a slower rate of increase in the cost of electricity. Indeed, these ratings provide a close approximation of the relative amounts of time spent on these sets of issues in adjudicative and ASLB hearings. Paradoxically, a somewhat different picture emerges when the likelihoods of the various outcomes and their associated desirability/undesirability are examined in Tables 2 and 3. Having sufficient electricity and a clean, reliable source of electricity were seen as the most desirable outcomes, followed by slower rates of increase in electric bills and positive economic gains for the local areas. Pollution, radiation and construction disturbances were seen as quite undesirable. The potential adverse impacts were seen as less likely to occur than the positive consequences. Apparently taking both positive and negative consequences into account, the Nuclear Regulatory Commission decided in successive hearings that the benefits likely to accrue from the Bailly plant outweighed the costs and the risks of deleterious consequences.

In general, this analysis would suggest that the citizens are primarily concerned with local economic issues in such situations. The environmentalist groups are not getting their message across in a persuasive fashion. The citizens do not share the confidence in the safety of nuclear power expressed by utilities and by NRC. These groups are also not getting their message across in a very persuasive fashion. At the same time, the groups opposed to the plant greatly underestimated the attractiveness of a nuclear power plant in the area to many citizens.

Conclusions

Three points which emerged from these data appear particularly noteworthy: (a) the "rationality" exhibited by the citizens; (b) the high level of concern expressed by all groups of citizens about possible negative side effects of the Bailly plant; and (c) the broad scope of concerns weighed by the ASLB in reaching their decisions.

The various groups of citizens were eminently rational in holding their particular positions--for those groups favoring the plant the expected value of the projected benefits outweighed the expected costs of the negative consequences. Thus all groups were correctly using their perceptions of risks, costs, benefits, and likelihoods in arriving at their positions. The disagreements between the various groups reflected primarily different perceived likelihoods, and to a lesser extent different levels of perceived benefits/costs. Clearly the citizens in such circumstances are capable of arriving at rational decisions on complex technical issues which involve complex trade-offs among non-equivalent quantities. Disagreements among citizens and technical experts in the present study were certainly not due to any irrationality on the part of the citizens. Rather, they appear to be due primarily to differences of opinion about the likelihood of both desirable and undesirable outcomes. This difference is highlighted in the relatively high likelihood all groups of citizens attached to the potential negative outcomes of pollution and radiation. While this discrepancy might be attributable to some degree of conservatism by the citizens (a tendency to overestimate the likelihood of rare events and to underestimate the likelihood of very probable events); the lack of a corresponding degree of conservatism in their ratings of the desirable, probable outcomes would argue against such an interpretation. Rather, from the present data it would appear that the citizens are simply more skeptical of the available information on safety and pollution than are the "technical experts."

The safety and pollution issues were of concern to all groups of citizens in the present study, not just those who were opposed to the construction of the Bailly plant. This would appear to reflect a general skepticism about nuclear power in general and not simply at a particular site. However, the decision process involved in nuclear power plant siting does not permit concerned citizen groups to raise such general issues which are their primary concerns. Similarly, institutional restrictions placed on the Federal agencies involved also force them to consider only site specific issues in a way that precludes the effective resolution of conflicting positions by the direct participants through any means other than the courts. This problem was compounded in the case of Bailly by the actions of the White House Domestic Council in restraining activities by the Department of the Interior. In the present case, ASLB was, logically, satisfied with their consideration of environmental issues, particularly when they heard very little directly from the Department of the Interior. Department of the Interior was clearly frustrated and also, logically, felt that their concerns did not receive adequate attention.

The present data clearly indicate that a broad range of potential impacts of the proposed Bailly plant were given careful attention by the ASLB. Although they were generally optimistic concerning potential benefits, they were also moderately pessimistic about potential negative impacts. Critics have sometimes charged that the ASLB, many of whose members began service in the Atomic Energy Commission, bring a strong pro-nuclear bias to their deliberations. If this is the case, the present data indicate that the only place where such a bias might enter is in their estimates of probabilities of various consequences, and not in the importance they attached to various potential consequences.

Finally, it is clear that the utility companies and Federal Agencies must take more cognizance of the reservations about nuclear power plants held by all citizens. They must also take the lead in communicating their concerns more effectively to such groups and the public if such costly delays are to be avoided in the future.

References and Notes

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Table 1

Subjects

Number of Interviews	Group	Position
	DIRECT PARTICIPANTS (extensive personal interviews)	
2	Northern Indiana Public Service Company	Technical and administrative personnel
5	Joint Intervenors	
	Izaak Walton League of Porter County, Indiana	Officer
	City of Gary, Indiana	Representative to Indiana legislature from Gary district
	State of Illinois	Attorney, Office of Illinois Attorney General
	Businessman for the Public Interest	Counsel resident
	Residents of Bailly area	
1	U.S. Environmental Protection Agency	Official from bureau responding to initial EIS
2	U.S. Department of the Interior	Assistant Secretary, Officials from National Park Service
3	U.S. Nuclear Regulatory Commission	
	Argonne National Laboratory	Technical consultant on Bailly proposal
	Atomic Safety and Licensing Board which heard Bailly case	Members of the board
	CITIZENS (structured telephone interviews of 10-15 minutes)	
Sample: 155 Completed: 119	Proximal Sample	Random sample of adults living within 15 miles of the Bailly site. Sample does not depart significantly from 1970 census for age, education, home ownership.
Sample: 155 Completed: 123	Distal Sample	Random sample of adults living more than 15 and less than 30 miles from the Bailly site. Sample does not depart significantly from 1970 census for age, education, etc.

Table 2

Summary of Questions on Perceived Costs, Risks, Benefits of Proposed Bailly Nuclear Power Plant

DIRECT PARTICIPANTS	CITIZENS
Position on Bailly Plant	
Open-ended questions:	Four-point closed scales:
Describe group's position on proposed Bailly plant	Feelings about the use of nuclear technology to meet energy needs (strongly in favor to strongly opposed)
Describe factors influencing position	Feelings about a nuclear power plant at the Bailly site. (strongly in favor to strongly opposed)
Assign relative importance to factors mentioned	
Perceptions of Costs, Risks, Benefits	
Closed questions, rated by judges on a nine-point scale:	Closed questions, rated by respondents on a four-point scale:
The relative likelihood of occurrence . . .	The relative likelihood of occurrence . . .
The relative desirability . . .	The relative desirability . . .
The relative importance in arriving at position on Bailly . . .	The relative importance in arriving at position on Bailly . . .
of each of the following:	of each of the following:
Positive Consequences[1]	Positive Consequences[1]
Sufficient energy to meet increased future needs	Electricity available when you need it
Slower rate in increase in costs of electricity	Decrease in your electric bills
Creation of more jobs in the area	More jobs in the area
Attraction of more business to the area	More business in the area
Nuclear power as a clean, reliable source of electricity[3]	
Negative Consequences[1]	Negative Consequences[1]
Construction:[2]	Construction:
Disturbances during construction (e.g., noise, sand, increased traffic, etc.)	

(Continued)

Table 2

(Continued)

Negative Consequences[1]	Negative Consequences[1]
Lowering of water table due to dewatering during construction	
Pollution:[2]	Pollution
Pollution of Lake Michigan from chemical or thermal sources	
Erosion of lakeshore due to surface water runoff	
Danger of radiation leakage	Radiation
Changes in character of surrounding neighborhoods	Too much industry
Detriment to scenic beauty:[2]	Detriment to scenic beauty[3]
Cooling plume would be unsightly	
Decrease in value of surrounding residential property	
Interference with management[3] of adjacent Dunes National Lakeshore in case of emergency at Bailly plant	Interference with access to or use of Dunes National Lakeshore[3]

[1] Originally, the language used in the two interview schedules was identical. A pretest with the citizens resulted in the abbreviated and somewhat altered forms of the questions being developed so as to be more comprehensible and meaningful to this group of respondents.

[2] Indexes of construction, pollution, and detriment to scenic beauty were created by averaging responses to the two specific consequences following each index title.

[3] Not offered as potential consequence in closed questions. Volunteered sufficiently frequently to warrant inclusion in analysis.

Table 3

Mean Ratings of the Desirability of Possible Consequences

Associated with the Construction of Bailly

Groups	n	Suff. Elect.	Decelerate Rate of Increase in Cost	More Jobs in Area	More Business in Area	Clean & Reliable	Pollution	Radiation*	Constr. Disturb.	Too Much Industry	Interfere w/ Park * Management	Impair Scenic Beauty
						Consequences						
Proximal Sample												
P-P	47	3.45_{a} 40	3.76_{c} 17	3.31_{c} 26	2.63_{a} 19	--	-2.28_{bc} 36	-2.45_{a} 38	-1.89_{ab} 9	-2.44_{ab} 9	--	--
P-U	14	3.40_{a} 10	3.67_{bc} 6	3.33_{c} 12	2.67_{a} 9	--	-2.33_{abc} 9	-2.56_{a} 9	-2.25_{ab} 4	-2.00_{ab} 2	--	--
P-A	13	2.20_{a} 10	3.00_{bc} 4	3.20_{bc} 10	$-.67_{a}$ 3	--	-3.00_{ab} 12	-3.08_{a} 12	-3.00_{ab} 1	-2.75_{ab} 4	--	--
A-A	10	2.28_{a} 7	3.50_{bc} 4	2.75_{bc} 8	1.60_{a} 5	--	-3.44_{ab} 9	-3.56_{a} 9	-3.67_{a} 3	-3.67_{a} 3	--	--
Distal Sample												
P-P	34	3.31_{a} 29	3.60_{bc} 20	2.92_{bc} 24	2.50_{a} 16	--	-2.13_{bc} 23	-2.55_{a} 29	-2.67_{ab} 6	-2.71_{ab} 7	--	--
P-U	15	3.20_{a} 10	3.00_{bc} 6	2.60_{bc} 10	1.33_{a} 9	--	-2.09_{bc} 11	-2.62_{a} 13	-1.50_{ab} 2	-1.67_{ab} 3	--	--
P-A	12	2.86_{a} 7	3.20_{bc} 5	2.40_{abc} 5	2.67_{a} 3	--	-3.17_{ab} 12	-3.22_{a} 9	-3.00_{ab} 6	-3.25_{a} 5	--	--
A-A	9	2.44_{a} 9	3.20_{bc} 5	1.00_{abc} 4	2.67_{a} 3	--	-3.67_{a} 9	-3.22_{a} 9	-3.00_{ab} 4	-3.20_{a} 5	--	--
Joint Intervenors	44	$.36_{b}$	$-.66_{a}$	$.25_{a}$	$-.14_{a}$	$.55_{a}$	-3.66_{a}	-3.68_{a}	-2.52_{ab}	-2.63_{ab}	-1.27_{a}	-2.93_{a}
Dept. of Interior	13	2.00_{a}	2.15_{bc}	$.92_{ab}$	0.00_{a}	1.00_{ab}	-3.23_{ab}	-3.85_{a}	-2.69_{ab}	-2.00_{ab}	-1.38_{a}	-3.08_{a}
Environ. Protect. Agency	6	2.33_{a}	2.33_{bc}	1.83_{abc}	1.33_{a}	1.67_{ab}	-2.67_{abc}	-2.00_{a}	-2.00_{ab}	-1.17_{ab}	-1.50_{a}	-1.83_{ab}
NIPSCO	18	3.50_{a}	3.44_{bc}	2.61_{bc}	2.44_{a}	2.94_{c}	-1.72_{c}	-2.39_{a}	-1.11_{b}	-1.17_{ab}	$- .44_{a}$	-1.17_{b}
Nuc. Reg. Comm.	22	3.09_{a}	1.27_{b}	1.14_{abc}	1.14_{a}	1.86_{b}	-3.00_{ab}	-2.95_{a}	-2.45_{ab}	-1.00_{b}	$- .41_{a}$	$- .73_{b}$
Overall $\bar{X}$		2.52	1.98	1.97	1.29	1.37	-2.81	-2.96	-2.33	-2.11	- .97	-2.11
F Ratio		13.95	16.30	7.70	4.30	17.40	7.55	3.84	3.20	4.86	4.63	15.32
df		12/212	12/157	12/189	12/157	4/98	12/211	12/218	12/125	12/127	4/98	4/98

All F-ratios were significant at beyond the .01 level.

Note: The Groups in the citizen samples were: P-P (Pro Nuclear Power/Pro Bailly Plant); P-U (Pro Nuclear Power/Undecided about Bailly Plant), P-A (Pro Nuclear Power/Anti Bailly Plant); A-A (Anti Nuclear Power/Anti Bailly Plant).

*Despite a significant overall F-ratio, Newman Keuls procedures did not indicate any significant differences among all possible pairings of subgroup means on this variable.

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The entries in each cell refer to the mean rating given to a potential outcome by those persons in that subgroup who were aware of such an outcome. The second value indicates the number of persons within the subgroup on whom the mean rating is based.

The differing numbers of judgments indicated for the direct decision participants reflect the differing number of persons in each group who were interviewed and the fact that not all judges rated all the interviews.

Table 4

Mean Ratings of the Likelihood of Possible Consequences

Associated with the Construction of Bailly

						Consequences						
Groups	n	Suff. Elect.	Slower Rate of Inc.	More Jobs	More Business In Area	Clean & Reliable	Pollution	Radiation	Constru. Disturb.	Too Much Industry	Interfere w/ Park * Management	Impair Scenic Beauty
Proximal Sample												
P-P	47	7.75_{b}	5.00_{abc}	7.62_{c}	6.89_{ab}	--	4.11_{a}	3.79_{bc}	3.89_{ab}	5.00_{ab}	--	--
P-U	14	7.00_{ab}	6.00_{abc}	7.50_{c}	6.56_{ab}	--	4.33_{bc}	5.00_{cd}	6.00_{bcd}	2.00_{ab}	--	--
P-A	13	6.20_{ab}	4.00_{abc}	7.20_{bc}	7.00_{ab}	--	7.17_{c}	6.17_{cd}	5.00_{abcd}	7.50_{b}	--	--
A-A	10	6.50_{ab}	6.00_{abc}	8.25_{c}	7.40_{b}	--	7.44_{c}	7.67_{d}	8.33_{d}	8.33_{b}	--	--
Distal Sample												
P-P	34	8.10_{b}	6.90_{c}	7.33_{c}	7.50_{b}	--	4.04_{b}	3.41_{bc}	4.67_{abc}	5.00_{ab}	--	--
P-U	15	7.40_{ab}	5.67_{abc}	7.20_{bc}	5.44_{ab}	--	5.91_{bc}	4.23_{bc}	7.00_{cd}	4.33_{ab}	--	--
P-A	12	7.29_{ab}	6.20_{bc}	5.80_{abc}	7.67_{b}	--	5.50_{bc}	7.22_{d}	6.33_{bc}	6.50_{b}	--	--
A-A	9	7.22_{ab}	5.00_{abc}	7.00_{abc}	6.50_{ab}	--	7.67_{c}	6.56_{d}	6.50_{cd}	6.00_{ab}	--	--
Direct Participants												
Joint Intervenors	44	6.27_{ab}	2.27_{a}	5.02_{ab}	4.00_{a}	1.57_{a}	6.89_{c}	5.31_{cd}	6.11_{bcd}	5.29_{ab}	1.55_{a}	7.93_{c}
Dept. of Inter.	13	5.30_{a}	3.63_{ab}	5.15_{abc}	4.08_{ab}	1.77_{ab}	6.07_{bc}	4.23_{bc}	7.00_{cd}	5.00_{ab}	3.15_{a}	7.77_{c}
Environ. Prot. Agency	6	4.17_{a}	4.00_{abc}	3.00_{a}	2.67_{a}	3.17_{abc}	4.67_{bc}	3.33_{abc}	3.33_{ab}	2.50_{ab}	1.00_{a}	3.16_{a}
NIPSCO	18	8.39_{b}	5.00_{abc}	5.22_{abc}	4.67_{ab}	4.39_{c}	1.56_{a}	1.17_{a}	2.22_{a}	1.67_{a}	1.00_{a}	3.39_{a}
Nuc. Reg. Comm.	22	7.36_{ab}	6.63_{c}	6.59_{abc}	6.23_{ab}	3.41_{bc}	4.62_{bc}	2.13_{ab}	3.45_{ab}	4.45_{ab}	1.00_{a}	5.86_{b}
Overall $\bar{X}$		7.09	4.69	6.32	5.44	2.57	5.25	4.27	5.01	4.62	1.54	6.40
F ratio		4.41	7.53	5.21	5.36	5.11	8.80	11.33	13.00	4.29	3.64	18.34
df		12/213	12/157	12/190	12/169	4/98	12/211	12/218	12/125	12/126	4/98	4/98

All F-ratios were significant at beyond the .01 level.

Note: The Groups in the citizen samples were: P-P (Pro Nuclear Power/Pro Bailly Plant); P-U (Pro Nuclear Power/Undecided about Bailly Plant); P-A (Pro Nuclear Power/Anti Bailly Plant): A-A (Anti Nuclear Power/Anti Bailly Plant).

*Despite a significant overall F-ratio, Newman Keuls procedures did not indicate any significant differences among all possible pairings of subgroup means on this variable.

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The entries in each cell refer to the mean rating given to a potential outcome by those persons in that subgroup who were aware of such an outcome. The second value indicates the number of persons within the subgroup on whom the mean rating is based.

The differing numbers of judgments indicated for the direct decision participants reflect the differing number of persons in each group who were interviewed and the fact that not all judges rated all the interviews.

Table 5

Mean Rating of the Importance of Possible Consequences Associated

With the Construction of Bailly

Groups	n	Suff. Elect.	Rate of Increase	More Jobs	Business	Clean Reliable	Pollution	Radiation	Constr. Disturb.	Too Much Industry	Interfere w/ Park Management	Impair Scenic Beauty
Proximal Sample												
P-P	47	8.10_{f} 40	6.65_{b} 17	6.77_{c} 26	7.11_{b} 19	--	5.86_{b} 35	5.84_{b} 38	5.22_{ab} 9	6.56_{bc} 9	--	--
P-U	14	7.60_{def} 10	7.67_{b} 6	6.50_{bc} 12	5.89_{ab} 9	--	4.78_{ab} 9	6.11_{b} 9	5.50_{ab} 4	8.00_{bc} 2	--	--
P-A	13	4.20_{abc} 10	5.00_{ab} 4	5.60_{bc} 10	7.00_{ab} 3	--	7.83_{b} 12	8.50_{b} 12	1.00_{a} 1	9.00_{c} 4	--	--
A-A	10	7.00_{cdef} 7	3.50_{ab} 4	5.75_{bc} 8	4.20_{ab} 5	--	8.11_{b} 9	8.50_{b} 8	9.00_{b} 3	7.00_{bc} 3	--	--
Distal Sample												
P-P	34	7.69_{ef} 29	7.20_{b} 20	7.08_{c} 24	7.63_{b} 16	--	5.26_{b} 23	5.90_{b} 29	5.33_{ab} 6	4.71_{bc} 7	--	--
P-U	15	7.20_{cef} 10	6.33_{b} 6	6.20_{bc} 10	5.22_{ab} 9	--	6.82_{b} 11	6.08_{b} 13	5.00_{ab} 2	3.00_{abc} 3	--	--
P-A	12	5.57_{bcde} 7	7.60_{b} 5	5.40_{abc} 5	5.00_{ab} 3	--	7.18_{b} 11	8.33_{b} 9	6.33_{ab} 6	4.50_{abc} 4	--	--
A-A	9	5.00_{abcd} 8	7.00_{b} 5	5.00_{ab} 4	6.33_{ab} 3	--	8.25_{b} 8	8.25_{b} 8	6.30_{ab} 4	6.20_{bc} 5	--	--
Direct Participants												
Joint Intervenors	44	2.11_{a}	1.64_{a}	3.11_{a}	3.32_{a}	1.05_{a}	6.93_{b}	7.36_{b}	4.45_{a}	4.86_{bc}	1.56_{ab}	5.57_{b}
Dept. of Interior	13	3.00_{ab}	2.15_{a}	2.08_{a}	3.23_{a}	2.15_{ab}	5.77_{b}	5.62_{b}	6.92_{b}	3.00_{abc}	3.69_{b}	7.62_{b}
Environ. Prot. Agency	6	2.00_{a}	2.00_{a}	1.50_{a}	1.67_{a}	2.33_{ab}	6.83_{b}	4.83_{ab}	3.67_{a}	2.17_{ab}	1.50_{ab}	3.83_{a}
NIPSCO	18	6.39_{cde}	6.89_{b}	3.89_{ab}	4.33_{ab}	4.06_{b}	3.06_{a}	2.67_{a}	3.44_{a}	1.11_{a}	1.00_{a}	6.50_{b}
Nucl. Reg. Commission	22	4.82_{abc}	4.36_{ab}	2.18_{a}	2.00_{a}	3.23_{b}	5.54_{b}	5.77_{b}	4.86_{a}	3.23_{abc}	1.18_{a}	6.50_{b}
Overall $\bar{X}$		5.49	4.59	4.58	4.43	2.25	6.13	6.28	4.93	4.14	1.65	6.05
F-ratios		24.75	15.02	11.00	8.27	7.69	4.85	5.93	3.84	6.32	5.13	8.72
df		12/211	12/157	12/189	12/157	4/98	12/208	12/216	12/125	12/127	4/98	4/98

All F-ratios were significant at beyond the .01 level.

Note: The Groups in the citizen samples were: P-P (Pro Nuclear Power/Pro Bailly Plant); P-U (Pro Nuclear Power/Undecided about Bailly Plant); P-A (Pro Nuclear Power/Anti Bailly Plant); A-A (Anti Nuclear Power/Anti Bailly Plant)

The entries in each cell refer to the mean rating given to a potential outcome by those persons in that subgroup who were aware of such an outcome. The second value indicates the number of persons within the subgroup on whom the mean rating is based.

The differing numbers of judgments indicated for the direct decision participants reflect the differing number of persons in each group who were interviewed and the fact that not all judges rated all the interviews.

APPENDIX B.

SCHEDULE FOR INTERVIEWS WITH DIRECT PARTICIPANTS IN THE CASE STUDY ON DRINKING WATER

Schedule for Interviews on Public Water Supplies

My name is _______________. I represent a group of people at Purdue University engaged in a project sponsored by the U. S. Dept. of the Interior. One purpose of our research is to gain a better understanding of decisions and choices about the quality of drinking water in the United States and particularly Indiana. The questions I will ask you are about your job and public drinking water supplies in Indiana.

1. First, let me be sure I have your name right--can you tell me your name ____________.

2. And what is the title of your present position? ____________________________________.

3. Can you tell me a little about your job and what your responsibilities are?

4. And how does your position relate to others in the organization or agency?

5. About how long have you been here at ______________________? Has your position been the same or have you held different positions while you've been at _________________?

6. Is your present job one that is elected or appointed?

7. Would you say that you have a role in making decisions about standards for public water supplies? How is that? Can you elaborate?

8. Would you say that you have a role in implementing or enforcing standards for water quality in Indiana? How is that?

9. Who would you say makes decisions about standards for water quality in Indiana? How is that?

   Are there particular people or agencies or organizations that make decisions about water quality for public water supplies?

10. Who would you say makes decisions about implementing or enforcing the standards for water quality in Indiana?

    Are there particular people or agencies that make decisions about implementing or enforcing standards for public water supplies?

11. What do you personally think the community feels about the kind of water service being delivered?

    a. For example, what are the general attitudes and feelings of the community toward the quality of the water? Do members of the community generally think the quality of the water is pretty good, not so good, or just what?

    b. How do you find out what the members of the community think or feel about the water supply?

12. Are there groups in the community or in the state that seem to be interested in water quality?

    Or in improving the quality of water in public supplies? What are those?

    If yes,
    a. Does your agency seem to have a working relationship with these groups? How is that?

    b. Are there groups in the community or state that have direct bearing on the quality of drinking water, or on the service supplied?

13. What would you say are the major institutions and organizations that are either directly or indirectly involved in the quality of water in public water supplies?

    a. For example, are there governmental agencies involved? What are those?

    b. Are there professional groups or associations involved? What are those?

    c. Are there community or citizen groups involved? What are those?

14.. What effects would you say each of these groups has on the operation of your agency? Can you give some examples?

15. How would you say the agency relates to each of these groups? Can you describe some of these relationships?

16. Would you say that your agency might have a responsibility for bringing information to or getting the views of the public on drinking water quality, or is this something the agency should not be concerned with?

17. A. In 1973, the Congress passed the SDWA which provides for new standards for drinking water in states and local communities. Do you happen to be aware of this act or of the new standards issued by the EPA?

    B. If yes, as you see it, will it be feasible to implement these new saandards?

    Could it be done immediately?

    Gradually?

    Or just what?

    C. Some people say the Federal Government should be highly involved in setting drinking water standards, while others feel that this should be done at the state and local level. What is your opinion.

18. Do you happen to know what standards are being implemented or enforced in the State of Indiana?
    A. Are the standards the same for all sources of water?

    B. Are specific tests carried out for:
        a. Biological Contaminants
        b. Chemical Contaminants
        c. Pleasantness
        d. Physical Properties
        e. Anything else not already mentioned

In the following questions, the term "testing schedule" refers to the list of tests of public water supplies carried out regularly by the State of Indiana as well as how often they are carried out.

19. A. As you see it, do the lab personnel generally understand the testing schedule and its importance?

    B. Would you say the policies towards testing are well-known to lab personnel or not so well known?

    C. Would you say there is general consensus among lab personnel or are there disagreements about what tests to apply?

    D. Who interprets the testing schedule to the lab personnel, especially to newcomers on the staff?

20. What do you think are the most important factors in deciding what to test for in public water supplies?

    Of the things you've mentioned, what do you think is the most important?

21. What do you think are the most important factors in deciding how often to test for particular substances in public water supplies? Of the things you've mentioned, what do you think is the most important?

22. In preparing the schedule for testing public water supplies, do you find that the schedule is much the same from month to month and year to year or does the schedule change?

    Can you give me an example?

23. Can you describe how the present schedule used for testing water supplies has come into use?

24. Do you personally think that there is any likelihood of dangerous contamination of a public water supply in Indiana?

25. Do you think the general public sees any likelihood of dangerous contamination of a public water supply in Indiana?

26. What do you feel is the role, if any, that the general public or organized groups of citizens should play in establishing the testing schedule for public water supplies?

27. I am going to hand you a list of items which may or may not be important in deciding what the testing schedule should be. Please rank these factors, giving the most important a "1", the second a "2", etc. If you feel any factors are irrelevant and should not be considered, please mark them with an "x".

Hand R Card 1

____ Size of population of community consuming the water
____ Time required for analysis
____ Available resources (including technicians) to carry out tests
____ Cost of analysis
____ Immediate consequences of not testing
____ Long-term consequences of not testing
____ Number of samples required for comprehensive testing
____ Accuracy of available tests
____ Federal regulations and guidelines (presently)
____ Other (please specify)

28. I am going to hand you a list of items that may be found in a drinking water supply. Please rank them with respect to how important you feel it is to test for them. Give a "1" to the item for which it is most important to test, a "2" to the second most important item, etc.

Hand R Card 2 and retrieve 1

____ Harmful viruses
____ Pesticides
____ Odor-causing substances
____ Harmful bacteria
____ Heavy Metals
____ Inorganic toxins (cyanide, etc.)
____ Murkiness
____ Radioactive substances
____ Other (please specify)

29. Please rank the items on the card (same as #28) with respect to the likelihood of their occurrence at unacceptable levels in a public water supply. Give the item most likely to occur a "1", the second most probable item a "2", etc. Hand R card 3 and retrieve 2

30. Please rank the items on the card (same as #28) with respect to likelihood of a serious illness or death (in humans) occurring due to that particular item. Give a "1" to the item considered most likely to cause such an event, etc.
    Hand R card 4 and retrieve 3

31. Is there anything else about your job, public drinking water supplies, etc. that I haven't asked that you feel I should know?

APPENDIX C.

SCHEDULE FOR INTERVIEWS WITH DIRECT PARTICIPANTS IN THE HERBICIDE ORANGE CASE

Elite Questionnaire

1. First I would like some background information. Would you give me your complete title and tell me a little about your job and your responsibilities?

2. How many years have you held this position?

3. Would you tell me how and why the decision not to proceed with the plan for disposing of Herbicide Orange in Utah was reached?

   Can you give me a brief summary of the events which led to the decision?

   Can you elaborate on that?

4. Who was responsible for making the decision not to proceed with the disposal plan in Utah?

   Was a single individual or group responsible for the decision or were there a number of individuals or groups who were responsible for the decision?

   Who were they?

5. Were you involved in this decision in any way, either directly or indirectly? If you were not involved with this decision, were you involved in any other way with the issue concerning the disposal of Herbicide Orange?

   If YES, would you tell me about your role in the decision? When did you first become involved?

   If NO, were you involved in any other way with the issue concerning the disposal of Herbicide Orange? When did you become involved? Can you tell me a bit about your involvement?

6. What was your position regarding the disposal of Herbicide Orange in Utah? Were you in favor of the proposal, against the proposal, or somewhere in between?

6a. What were the factors that influenced you to adopt this position?

6b. Of the factors that you have mentioned, would you consider any particular factor as most important in influencing your position?

Which one?

If NO, could you elaborate a bit?

7. Was (organization) involved in the decision not to proceed with the plan for disposing of Herbicide Orange in Utah in any way, either directly or indirectly?

If YES, would you tell me about its role in the decision? When did it first become involved?

If NO, was it involved in any other way with the issue concerning the disposal of Herbicide Orange? Can you tell me a little about its involvement?

8. What was (organization's) position or recommendation with regard to the disposal of Herbicide Orange in Utah? Was it in favor of the proposal, against the proposal, or somewhere in between?

8a. What were the factors that influenced (organization) to adopt this position?

8b. Of the factors that you have mentioned, do you think that any particular factor was most important in influencing (organization) to adopt its position?

9. In your opinion, would the disposal of Herbicide Orange through soil biodegradation involve any potential hazards?

If YES, can you give me some examples? And which of these potential negative consequences would be most likely to occur? Which of these potential consequences do you think would have the most harmful effects?

If NO, would you give me the reasons for your opinion?

10. Some people have mentioned the following as potential negative consequences of the disposal of Herbicide Orange through soil biodegradation. Would you please rate each consequence on the likelihood of its occurrence on a scale ranging from 1 = very unlikely to 9 = very likely.

	extremely unlikely	very unlikely	unlikely	moderately unlikely		moderately likely	likely	very likely	extremely likely
damage to commercial crops:	1	2	3	4	5	6	7	8	9
contamination of streams:									
contamination of ground water:									
entrance of the contaminant (dioxin) into the food chain:									
birth defects in wild animals:									
birth defects in domestic animals:									
allergic reactions in humans, e.g., skin disorders:									
miscarriages in humans:									
birth defects in humans:									

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10. (Continued)
Any others

(please specify) :___:___:___:___:___:___:___:___:___:
1 2 3 4 5 6 7 8 9

11. Further, some people have suggested that certain events could precipitate the [illegible] Please [illegible] each of the following events to occur?

	extremely unlikely	very unlikely	unlikely	moderately unlikely		moderately likely	likely	very likely	extremely likely
accident during transportation:	1	2	3	4	5	6	7	8	9
evaporation and subsequent wind movement with dispersion:									
evaporation and subsequent wind movement without dispersion:									
earthquake during incorporation:									
flash flood:									
theft or sabotage:									
any others:									
__________ please specify:	1	2	3	4	5	6	7	8	9

12. Now before we proceed to the next question, I would like to get some reference point for the likelihood estimates that you just made. For example, in any given year in the United States, the probabilities of dying in a car accident is about 1 in 4000. How would you rate this probability on the scale you just used?

(continued)

12. (Continued)

extremely unlikely	very unlikely	unlikely	moderately unlikely		moderately likely	likely	very likely	extremely likely
1	2	3	4	5	6	7	8	9

13. Assuming that each of the potential negative consequences listed below were to occur, would you please rate each in terms of its seriousness or cause for concern. For these ratings, the scale ranges from 1 = not at all serious or no cause for concern to 9 = very serious, of cause for grave concern.

	not at all serious								very serious
damage to commercial crops:	1	2	3	4	5	6	7	8	9
contamination of streams:									
contamination of ground water:									
entrance of the contaminant (dioxin) into the food chain:									
birth defects in wild animals:									
birth defects in domestic animals:									
allergic reactions in humans, e.g., skin disorders:									
miscarriages in humans:									
birth defects in humans:									
any others: please specify	1	2	3	4	5	6	7	8	9

14. Do you think that cost of disposal was a factor in the decision not to proceed with the disposal plan in Utah? Yes No

15. To what extent do you think that cost should be considered in making decisions of this kind?

Could you express this in terms of a scale where 1 = cost should not be a factor at all to 9 = cost should be very much a factor?

should not at all be a factor	should be very much a factor

:___:___:___:___:___:___:___:___:___:
 1 2 3 4 5 6 7 8 9

16. Was (organization's) advice or recommendation taken into consideration in the decision not to proceed with the plan to dispose of Herbicide Orange in Utah?

In what ways? To what extent was its recommendation considered?

17. Did you (or your organization) consider any alternative methods for the disposal of Herbicide Orange?

If YES, which one? Did (organization) have any preferences among the alternatives? Which one(s)? Why?

18. What organizations, groups, or individuals have been directly involved in the decision not to proceed with the disposal of Herbicide Orange in Utah?

Are there any others that you can recall?

Please answer question 19 for each organization, etc. mentioned in question 18.

19. What was the contribution of (each organization) to the decision?

19a. What was its position or recommendation?

b. In your opinion, what factors influenced its position or recommendation?

c. Please rate (each organization's) contribution to the decision on a scale ranging from 1 = not at all valuable to 9 = very valuable.

not at all valuable								very valuable
___	___	___	___	___	___	___	___	___
1	2	3	4	5	6	7	8	9

20. What organizations, groups, or individuals have been indirectly involved in the decision not to proceed with the disposal of Herbicide Orange in Utah?

Please answer question 21 for (each organization, etc.) you mentioned in question 20.

21. What was the contribution of each organization to the decision?

a. What was its position or recommendation?

b. In your opinion, what factors influenced its position or recommendation?

21c. Please rate (each organization's) contribution to the decision on a scale ranging from 1 = not at all valuable to 9 = very valuable.

not at all valuable								very valuable
1	2	3	4	5	6	7	8	9

22. In general, do you think that the people of Utah were well informed or poorly informed about the issue of disposing of Herbicide Orange in their state?

    In what ways were they well informed or poorly informed?

23. Did you receive any letters, telegrams, phone calls, etc. from individuals expressing their opinion on this matter?

    If YES, how many expressed a favorable opinion toward the plan to dispose of Herbicide Orange through soil biodegradation in Utah? What percentage of the total was this?

    How many expressed an unfavorable position? What percentage of the total was this?

24. Is there anything else about the issue of disposing of Herbicide Orange that I haven't asked that you think I should know?

APPENDIX D.

SCHEDULE FOR INTERVIEWS WITH DIRECT PARTICIPANTS IN THE CASE STUDY ON BAILLY NUCLEAR POWER PLANT

Bailly Elite Interview

1a. First I would like some background information. Would you give me your complete title and tell me a little about your job and your responsibilities.

b. How many years have you held this position?

c. And how does your position relate to others in the organization or agency?

2. Are or were you involved in any way, either directly or indirectly, in the events arising from the proposal to build and operate a nuclear power station at Bailly, Indiana?

If YES, would you tell me about your role in these events? When did you first become involved?

If NO, was your organization (group, etc.) involved in these events? When did it become involved? In what way(s) was it involved?

What is your position regarding the proposal to build and operate a nuclear power station at Bailly. Are you in favor of the proposal, against the proposal, or somewhere in between?

What factors influenced you to adopt this position?

Of the factors that you have mentioned, would you consider any particular factor as most important in influencing your position?

Which one?

If NO, could you elaborate a bit?

Some people have mentioned the following as potential positive consequences of building a nuclear power station at Bailly.

How likely do you think that the building of a nuclear power station at Bailly would result in each of the following. Please respond on a scale where 1 = extremely unlikely and 9 = extremely likely.

sufficient electricity to meet increased energy needs:	1	2	3	4	5	6	7	8	9
slower rate of increase in electricity costs:	1	2	3	4	5	6	7	8	9
more jobs in the area:	1	2	3	4	5	6	7	8	9
more business in the area:	1	2	3	4	5	6	7	8	9

other....

How desirable do you think these consequences would be if they were to occur? Please respond on a scale where 1 = very undesirable and 9 = very desirable.

sufficient electricity to meet increased energy needs:	1	2	3	4	5	6	7	8	9
slower rate of increase in electricity costs:	1	2	3	4	5	6	7	8	9
more jobs in the area:	1	2	3	4	5	6	7	8	9
more business in the area:	1	2	3	4	5	6	7	8	9

other...

How important was this issue in forming your (your company, organization's) attitude? Please respond on a scale where 1 = very unimportant and 9 = very important?

sufficient electritity to meet increased energy needs:	1	2	3	4	5	6	7	8	9
slower rate of increase in electricity costs:	1	2	3	4	5	6	7	8	9
more jobs in the area:	1	2	3	4	5	6	7	8	9
more business in the area:	1	2	3	4	5	6	7	8	9

other...

Some people have mentioned the following as potential negative consequences of building a nuclear power station at Bailly.

How likely do you think that the building of a nuclear power station at Bailly would result in each of the following. Please respond on a scale where 1 = extremely unlikely and 9 = extremely likely.

disturbances during construction, e.g., noise, sand, increased traffic, etc.	1	2	3	4	5	6	7	8	9
pollution of Lake Michigan from chemical sources (due to surface water runoff, ash ponds, and cooling tower)	1	2	3	4	5	6	7	8	9
radiation leakage	1	2	3	4	5	6	7	8	9
erosion to Lakeshore due to surface water runoff	1	2	3	4	5	6	7	8	9
lowering of the water table due to dewatering (slurry wall)	1	2	3	4	5	6	7	8	9
cooling tower and plume would be unsightly	1	2	3	4	5	6	7	8	9

decrease in property values	1	2	3	4	5	6	7	8	9
change in the character of neighborhoods	1	2	3	4	5	6	7	8	9
other........	1	2	3	4	5	6	7	8	9

How undesirable do you think these consequences would be if they were to occur? Please respond on a scale where 1 = very undesirable and 9 = very desirable.

disturbances during construction	1	2	3	4	5	6	7	8	9
pollution of Lake Michigan from chemical sources	1	2	3	4	5	6	7	8	9
radiation leakage	1	2	3	4	5	6	7	8	9
erosion to Lakeshore due to surface water runoff	1	2	3	4	5	6	7	8	9
lowering of the water table due to dewatering	1	2	3	4	5	6	7	8	9
cooling tower and plume would be unsightly	1	2	3	4	5	6	7	8	9
decrease in property values	1	2	3	4	5	6	7	8	9
change in the character of neighborhoods	1	2	3	4	5	6	7	8	9
other........	1	2	3	4	5	6	7	8	9

How important was each in forming your (your company's, organization's, etc.) attitude? Please respond on a scale where 1 = very unimportant and 9 = very important.

disturbances during construction	1	2	3	4	5	6	7	8	9
pollution of Lake Michigan from chemical sources	1	2	3	4	5	6	7	8	9

radiation leakage	1	2	3	4	5	6	7	8	9
erosion to Lakeshore due to surface water runoff	1	2	3	4	5	6	7	8	9
lowering of the water table due to dewatering (slurry wall)	1	2	3	4	5	6	7	8	9
cooling tower and plume would be unsightly	1	2	3	4	5	6	7	8	9
decrease in property values	1	2	3	4	5	6	7	8	9
change in the character of neighborhoods	1	2	3	4	5	6	7	8	9
other......	1	2	3	4	5	6	7	8	9

From what sources have you gathered information regarding these issues?

As we mentioned, a number of issues have been raised regarding the building and operation of the nuclear power station at Bailly In your opinion have these issues been fairly or unfairly presented?

In what ways?

Now I'm going to read you the names of groups which were involved (or are) in the events arising from the proposal to build and operate a nuclear power station at Bailly, Indiana. Please tell me how much influence you think each group has had.

a. NIPSCO...

b. Environmental Protection Agency...

c. Atomic Safety and Licensing Board...

d. State Government...

e. Scientists and other experts...

f. Citizens in the local community...

g. the panel of Federal judges hearing the arguments...

Could you express your responses for each group on a 9-point scale where 1 = no influence at all and 9 = a great deal of influence?

	no influence at all								
NIPSCO	1	2	3	4	5	6	7	8	9
Environmental Protection Agency	1	2	3	4	5	6	7	8	9
Atomic Safety & Licensing Board	1	2	3	4	5	6	7	8	9
State Government	1	2	3	4	5	6	7	8	9
Scientists & other experts	1	2	3	4	5	6	7	8	9
Citizens in the local community	1	2	3	4	5	6	7	8	9
Panel of judges	1	2	3	4	5	6	7	8	9

How would you tell how much influence you think each group should have.

a. NIPSCO...

b. Environmental Protection Agency...

c. Atomic Safety and Licensing Board...

d. State Government...

e. Scientists and other experts...

f. Citizens in the local community...

g. The panel of Federal judges hearing the arguments...

Could you express your responses for each group on a 9-point scale where 1 = no influence at all and 9 = a great deal of influence?

	no influence at all								
NIPSCO	1	2	3	4	5	6	7	8	9
Environmental Protection Agency	1	2	3	4	5	6	7	8	9
Atomic Safety & Licensing Board	1	2	3	4	5	6	7	8	9
State Government	1	2	3	4	5	6	7	8	9
Scientists and other experts	1	2	3	4	5	6	7	8	9
Citizens in the local community	1	2	3	4	5	6	7	8	9
Panel of judges	1	2	3	4	5	6	7	8	9

Do you (your company, organization, etc.) ever interact with any of these groups?

If YES, which ones? Could you describe the nature of the interaction? How often do you interact with each?

You've already told me your position regarding the proposal to build and operate a nuclear power station at Bailly. More generally, however, what are your feelings toward the use of nuclear technology to meet energy needs? Are you in favor, opposed, or somewhere in between depending on the particular situation?

Could you elaborate on that a bit?

Is there anything else about the Bailly nuclear power station that I have not asked, that you feel I should know?

(e.g., do you think that this issue could have been handled differently...)

Time ________________ *am* / *pm*

Quest. ID# ________

Study # 6901

Int. ID# ________

Sex of Respondent: M F

APPENDIX E.

INDIANA PUBLIC WATER SUPPLIES

CITIZEN INTERVIEW

Hello, my name is ____________________, and I am calling for the Institute of Science, Technology and Public Policy at Purdue University. We are interested in how public opinion develops and changes over time, and we would like to ask you some questions.

(If not now)
May I call you back at ________________?

I'd like to ask you a few questions about public drinking water, the water that comes from the tap in your home.

1. First, do you get the water in your home from a city water supply, or from your own well on your property?

City water supply-----------------------------1
Own well (End Interview)--------------------2
Some other source (Skip to Q. 3)------------3
(Specify) ____________________
Don't know (Skip to Q. 3)-------------------8

---

2. Does the water you get from the city come from a well below the ground, or from the surface in a lake or river?

Below the ground----------------------------1
Surface water-------------------------------2
Other---------------------------------------3
(Specify) ____________________________
Don't know----------------------------------8

(Ask only those in West Lafayette)

3. Do you live in Purdue University housing on the campus?

Yes (End Interview)-------------------------1
No---2

4a. From which one of the following sources do you get most of your local news.... *(Circle one)*

radio, --------------------------------------1
television, ---------------------------------2
newspaper, or -------------------------------3
some other way? -----------------------------4
(Specify) ____________________

b. Which one do you use least... *(Circle one)*

radio, --------------------------------------1
television, ---------------------------------2
newspaper, or -------------------------------3
some other way? -----------------------------4
(Specify) ____________________

5a. Would you say you discuss local politics with others...

All of the time, (*100%*)---------------------5
Most of the time, (*75%*)---------------------4
Some of the time, (*50%*)---------------------3
Seldom, or (*25%*)----------------------------2
Never? (*0%*) *(Skip to Q.15)*-----------------1

b. When discussing local politics with others, would you say you offer your opinion...

All of the time, (*100%*)---------------------5
Most of the time, (*75%*)---------------------4
Some of the time, (*50%*)---------------------3
Seldom, or (*25%*)----------------------------2
Never? (*0%*)---------------------------------1

6a. During an average month, with how many different people do you discuss local politics?

One -- 1
Two -- 2
Three -------------------------------------- 3
Four --------------------------------------- 4
Five or more ------------------------------- 5

b. How frequently do you get together with these people socially? Would you say...

Daily, --------------------------------------- 7
A few times a week, -------------------------- 6
Once a week, --------------------------------- 5
Twice a month, ------------------------------- 4
Once a month, -------------------------------- 3
Less than once a month, or ------------------- 2
Never? --------------------------------------- 1

Most of us have conversations with different types of people. We'd like to know something about the people you generally talk to.

7. Are most of them...

married, ------------------------------------- 1
divorced or separated, ----------------------- 2
widowed, or ---------------------------------- 3
never married? ------------------------------- 4

Don't know --------------------------------- 8

8. Are most of them the head of the household, the spouse of the head, or some other family member?

Head --------------------------------------- 1
Spouse of head ----------------------------- 2
Other (Specify) ______________________ ---- 3

Don't know --------------------------------- 8

9. Are most of them...

male or ------------------------------------1
female? ------------------------------------2
Both --------------------------------------3

---

10. Do most of them own or rent their home?

Own---1
Rent--2
Both--3

Don't know----------------------------------8

---

11. What is the highest grade of school most of them have completed?

None--00
Elementary-----------01 02 03 04 05 06 07 08
High School----------------------09 10 11 12
College--------------------------13 14 15 16
Some graduate school----------------------17
Graduate or professional degree-----------18

Don't know--------------------------------88

---

12. Are most of them...

Under 20, ---------------------------------1
In their 20's, ----------------------------2
30's, -------------------------------------3
40's, -------------------------------------4
50's, or ----------------------------------5
60's or over? -----------------------------6

---

13. Is the total family income of most of the people you talk to...

More than $5,000? No----------------------1
More than $10,000? No---------------------2
More than $15,000? No---------------------3
More than $20,000? No---------------------4
More than $25,000? No---------------------5
More than $30,000? No---------------------6
Yes---------------------7

Don't know------------------------------------8
Refused---------------------------------------9

14. Of what race or ethnic group are most of them?

White---1
Black---2
Other (Specify) ______________________ ---3

15. Would you say the overall quality of the water that comes from the tap in your home is...

Excellent, ---------------------------------1
Adequate, ----------------------------------2
Less than adequate, or ---------------------3
Poor? --------------------------------------4

Don't know--------------------------------8

16. Would you say the appearance or color of the water that comes from the tap is...,

Excellent, ---------------------------------1
Adequate, ----------------------------------2
Less than adequate, or ---------------------3
Poor? --------------------------------------4

Don't know--------------------------------8

17. Would you say for drinking the water that comes from the tap is...

Very safe,	1
Adequate,	2
Somewhat unsafe, or	3
Very unsafe?	4
Don't know	8

---

18. Would you say the water that comes from the tap is...

Very soft,	1
Soft,	2
Hard, or	3
Very hard?	4
Don't know	8

---

19. Is there anything in your drinking water when it comes out of the tap?

Yes	1
No (Skip to Q. 21)	2
Don't know (Skip to Q. 21)	8

20.	a. What is in your drinking water when it comes out of the tap? *(Circle all that apply)* *Don't know*——8	b. What is in your drinking water that is desirable? *(Circle all that apply)* *Don't know*——8 *Nothing*——2	c. What is in your drinking water that is undesirable? *(Circle all that apply)* *Don't know*——8 *Nothing*——2	*(Ask only for those mentioned in "c")* d. Do you think that removing ______ from the drinking water is...				
				Very Important,	Important,	Unimportant, or	Very Unimportant?	Don't know
Calcium	1	1	1	1	2	3	4	8
Carcinogen, cancer-causing	1	1	1	1	2	3	4	8
Chlorine	1	1	1	1	2	3	4	8
Fluoride	1	1	1	1	2	3	4	8
Heavy Metals	1	1	1	1	2	3	4	8
Industrial Chemicals	1	1	1	1	2	3	4	8
Iron	1	1	1	1	2	3	4	8
Mercury	1	1	1	1	2	3	4	8
Pesticides, Insecticides	1	1	1	1	2	3	4	8
Poison	1	1	1	1	2	3	4	8
Potassium	1	1	1	1	2	3	4	8
Salts	1	1	1	1	2	3	4	8
Algae	1	1	1	1	2	3	4	8
Animals	1	1	1	1	2	3	4	8
Animal Waste	1	1	1	1	2	3	4	8
Bacteria	1	1	1	1	2	3	4	8
Bugs	1	1	1	1	2	3	4	8
Human Waste	1	1	1	1	2	3	4	8
Plant Waste	1	1	1	1	2	3	4	8
Virus	1	1	1	1	2	3	4	8
Other *(Specify)* ______	1	1	1	1	2	3	4	8
Other *(Specify)* ______	1	1	1	1	2	3	4	8
Other *(Specify)* ______	1	1	1	1	2	3	4	8

21. Is your drinking water tested?

Yes--1
No---2
Don't know---------------------------------8

---

22. Whom would you contact if you thought there might be some problem with the quality of water that comes from the tap? *(Circle all that apply)*

Water company------------------------------1
City government or official----------------2
State government or official---------------3
Federal government or official-------------4
Other (Specify) ______________________ ----5
Don't know---------------------------------8

23a. Have you or anyone in your family ever contacted anyone about the quality of water that comes from the tap?

Yes--1
No (Skip to Q. 24)-------------------------2
Don't know (Skip to Q. 24)-----------------8

---

b. Who was contacted about the quality of water? *(Circle all that apply)*

Water company------------------------------1
City government or official----------------2
State government or official---------------3
Federal government or official-------------4
Other (Specify) ______________________----5
Don't know---------------------------------8

24. Now I'm going to read you names of some groups that may or may not have some authority to make decisions about the quality of public water, such as deciding what to test for and how often to test. Please tell me how much authority each group should have in making decisions of this kind.

	A great deal of authority,	A moderate amount of authority,	A little authority,	or no authority at all?	*Don't know*
a. The federal government in Washington? Should they have...	1	2	3	4	8
b. The water company? Should it have...	1	2	3	4	8
c. The state government?	1	2	3	4	8
d. Scientists and other experts?	1	2	3	4	8
e. Citizens in the local community?	1	2	3	4	8
f. Local government?	1	2	3	4	8

25. How much authority do you think each group does have in making decisions about the quality of public water, such as deciding what to test for and how often?

a. The federal government? Do they have...	1	2	3	4	8
b. The water company? Does it have...	1	2	3	4	8
c. The state government?	1	2	3	4	8
d. Scientists and other experts?	1	2	3	4	8
e. Citizens in the local community?	1	2	3	4	8
f. Local government?	1	2	3	4	8

26. When policy-makers make decisions involving scientific or technical questions, would you say they are very aware, somewhat aware, or not at all aware of the opinions and attitudes of citizens like yourself?

Very aware------------------------------------1
Somewhat aware--------------------------------2
Not at all aware------------------------------3

Don't know------------------------------------8

---

27. When policy-makers make decisions involving scientific or technical questions do you think the opinions and attitudes of citizens like yourself make...

A great deal of difference, ----------------1
A moderate amount of difference, -----------2
A little difference, or --------------------3
No difference at all? ----------------------4

Don't know------------------------------------8

28a. Have you ever discussed the quality or safety of drinking water with your friends or others outside your family?

Yes---1
No (Skip to Q. 29)----------------------------2

---

b. Of those with whom you usually talk, how many are generally satisfied with the overall quality of the water that comes from the tap? Would you say...

All, *(100%)*-----------------------------------1
Most, *(75%)*-----------------------------------2
About half, *(50%)*-----------------------------3
A few, or *(25%)*-------------------------------4
None? *(0%)*------------------------------------5

Don't know------------------------------------8

---

c. Of those with whom you usually talk, how many are satisfied with the safety of the water that comes from the tap? Would you say...

All, *(100%)*	1
Most, *(75%)*	2
About half, *(50%)*	3
A few, or *(25%)*	4
None? *(0%)*	5
Don't know	8

Now we have some background questions to help us to analyze the data.

29. In what year were you born? ________________

After 1956	1
1947-1956	2
1937-1946	3
1927-1937	4
1917-1926	5
Before 1917	6

---

30. Are you currently...

Married,	1
Divorced or separated,	2
Widowed, or	3
Never married?	4

---

31. Do you own or rent your home?

Own	1
Rent	2

---

32. What is the highest grade of school you have completed?

None	00
Elementary	01 02 03 04 05 06 07 08
High School	09 10 11 12
College	13 14 15 16
Some graduate school	17
Graduate or professional degree	18
Refused	99

33. Was your family income before taxes last year, 1975,...

More than $5,000? No----------------------1
More than $10,000? No----------------------2
More than $15,000? No----------------------3
More than $20,000? No----------------------4
More than $25,000? No----------------------5
More than $30,000? No----------------------6
Yes---------------------7

Don't know-----------------------------------8
Refused--------------------------------------9

34. What is your political preference? Are you...

Republican, *(Skip to Q. 35a)*----------------1
Democrat, *(Skip to Q. 35b)*------------------2
Independent, or *(Skip to Q. 35c)*------------3
Something else? ----------------------------4
*(Specify)*________________________
(End Interview)

Don't know, no preference (End Interview)---8

35a. Do you consider yourself a strong Republican or a not very strong Republican?

Strong Republican--------------------------1
Not very strong Republican-----------------2
(End Interview)

b. Do you consider yourself a strong Democrat or a not very strong Democrat?

Strong Democrat----------------------------1
Not very strong Democrat-------------------2
(End Interview)

party? consider yourself closer to the Republican party or the Democratic

Republican	1
Democratic	2

(End Interview)

THANK YOU FOR YOUR COOPERATION.

Time ______________ *am* / *pm*

Ques. ID# ______
Study # 6903
Int. ID# ______

APPENDIX F.

Time Interview began ______ AM - PM

Sex of Respondent M F

BAILLY NUCLEAR POWER PLANT

CITIZEN INTERVIEW

Hello, my name is ____________________, and I am calling from Purdue University. We are interested in how public opinion about local issues develops and changes over time, and we would like to ask you some questions.

If not now,
Why don't I call you back at __________________.

1a. From which one of the following sources do you get most of your local news, ...
(Circle one)

radio, ...1
television,..................2
newspaper,...................3
friends,, or 4
some other way?.............5
(Specify)

____

b. Which one do you use least,........*(Circle one)*

radio,.......................1
television,..................2
newspaper,...................3
friends, or 4
some other way?.............5
(Specify)

____

2a Would you say you discuss local politics and issues with others..........

all of the time, (100%).....5
most of the time, (75%).....4
some of the time, (50%).....3
seldom, or (25%)............2
never? (0%)*(Skip to Q.12)*...1

b. When discussing local politics and issues with others, would you say that you offer your opinion......

all of the time, (100%).....5
most of the time, (75%).....4
some of the time, (50%).....3
seldom (25%), or............2
never? (0%).................1

3a. During an average month, with how many different people do you discuss local politics and issues?

one............................1
two............................2
three..........................3
four...........................4
five or more...................5

b. How frequently do you get together with these people socially? Would you say...

daily,.........................7
a few times a week,............6
once a week,...................5
twice a month,.................4
once a month,..................3
less than once a month, or ..2
never?.........................1

Most of us have conversations with different types of people. We would like to know something about the people you generally talk to about local politics and issues.

4. Are most of them....

married,.......................1
divorced or separated,.......2
widowed, or 3
never married?.................4

don't know.....................8

5. Are most of them the head of the household, the spouse of the head, or some other family member?

head...........................1
spouse of the head...........2
other *(Specify)*..............3

____

don't know.....................8

6. Are most of them...

male, or.......................1
female?........................2
both...........................3

7. **Do most of them own or rent their home?**

own	1
rent	2
both	3
don't know	8

8. **Are most of them....**

under 20,	1
in their 20's,	2
30's,	3
40's,	4
50's, or	5
60's or over?	6

9. **Of what race or ethnic group are most of them?**

white	1
black	2
other *(Specify)*	3

Now we would like to ask you some questions about a local issue that you may or may not have heard about during the past 6 years.

10. **Have you heard of the Bailly Nuclear Power Plant?**

yes	1
no *(Skip to Q.26)*	2

11. **In what year did you first hear about the Bailly Nuclear Power Plant?**

Prior to 1971	1
between 1971 and 1972	2
between 1973 and 1974	3
between 1975 and 1976	4
other *(Specify)*	5

12. **How did you first hear about the plan to construct a nuclear power plant at the Bailly site? Was it through............*(Circle one)***

radio,	1
television,	2
newspaper,	3
friends, *or*	4
some other way? *(Specify)*	5

13a. Do you know where the proposed Bailly Nuclear Power Plant would have been located?

yes............................1
no/not sure *(Skip to Q 16)*....2

b. Where? ______________________________

	Strongly In Favor	In Favor	Opposed	Strongly Opposed	Don't Know
14a. What are your feelings about a nuclear power plant at the Bailly site? Are you...	1	2	3	4	8
b. What were your feelings about a nuclear power plant at the Bailly site when you first heard about it? Were you...	1	2	3	4	8
c. What are your feelings about the use of nuclear technology in general to meet energy needs? Are you...	1	2	3	4	8

15. How satisfied are you with the way...

	Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	Don't Know
a. environmental issues concerning nuclear power plants have been treated? Are you...	1	2	3	4	8
b. issues concerning nuclear power plants as a source of energy have been treated? Are you....	1	2	3	4	8

16. Now I'm going to read you the names of groups that may or may not have some authority to make decisions such as deciding to construct and operate a nuclear power plant. Please tell me how much authority each group should have in making decisions of this kind.

	A great deal of authority	A moderate amount of authority	A little authority	No authority at all	Don't know
a. The Federal Government in Washington? Should it have...	1	2	3	4	8
b. The company planning to build the nuclear power plant? Should it have...	1	2	3	4	8
c. The State Government? Should it have...	1	2	3	4	8
d. Scientists and other experts? Should they have...	1	2	3	4	8
e. Citizens in the local community? Should they have...	1	2	3	4	8

17. Which of the following do you think were involved in decisions about a nuclear power plant at the Bailly site

	yes	no	don't know
a. Federal Government?....................	1	2	8
b. State Government?......................	1	2	8
c. Environmental Protection Agency?......	1	2	8
d. Atomic Safety & Licencing Board?......	1	2	8

18a. Of the people with whom you usually talk, how many were in favor of a nuclear plant site at the Bailly site? Would you say...

All (100%) *(Skip to Q24)*..............	5
Most (75%)............................	4
About half (50%)......................	3
A few (25%)...........................	2
None (0%).............................	1

b. How many were opposed? Would you say....

All (100%)............................	5
Most (75%)............................	4
About half (50%)......................	3
A few (25%)...........................	2
None (0%).............................	1

19. When making decisions, do you feel that policy-makers take the public opinion into consideration...

a great deal,..................1
a moderate amount,..........2
a little, or.....................3
not at all?......................4

don't know.....................8

20. Now we would like to ask for your opinion about several arguments for the Bailly Nuclear Power Plant.

	Electricity available when you need it	Decrease in your electric bills	More jobs in the area	More business in the area	Other (Specify)
a. What arguments have you heard for the Bailly Nuclear Power Plant? → (Circle all mentioned)	1	1	1	1	______ ______ ______
Ask only for those not mentioned inQ24a					
b. Now I'm going to read you a list of things you may or may not have heard in favor of the Bailly Nuclear Power Plant. Please stop me when you hear an issue you have heard about. →					
Yes	1	1	1	1	
No	2	2	2	2	
Ask only for those mentioned in Q 24a or 'Yes' in Q 24b. ↓					
c. How likely do you think it is that the Bailly Nuclear Power Plant would result in ______. Is it...					
Very likely,	1	1	1	1	1
Likely,	2	2	2	2	2
Unlikely, or	3	3	3	3	3
Very Unlikely?	4	4	4	4	4
Don't know	8	8	8	8	8
d. Do you think that ______ would be...					
Very desirable,	1	1	1	1	1
Desirable,	2	2	2	2	2
Undesirable, or	3	3	3	3	3
Very undesirable?	4	4	4	4	4
Don't know	8	8	8	8	8
e. How important was this issue in forming your opinion about the Bailly nuclear power plant? Was it...					
Very important,	1	1	1	1	1
Important,	2	2	2	2	2
Unimportant, or	3	3	3	3	3
Very unimportant?	4	4	4	4	4
Don't know	8	8	8	8	8

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21. **We would like to ask for your opinion about several arguments against the Bailly Nuclear Power Plant.**

	Pollution?	Radiation?	Construction?	Too much industry?	Other *(Specify)*
a. What arguments have you heard against the Bailly Nuclear Power Plant? → *(Circle all mentioned)*	1	1	1	1	______ ______
Ask only for those not mentioned in Q24a.					
b. Now I'm going to read you a list of things you may or may not have heard against the Bailly Nuclear Power Plant. Please stop me when you hear an issue you have heard about. Problems with ____ →					
Yes	1	1	[illegible]	1	
No	2	2	[illegible]	2	
Ask only for those mentioned in Q24a or 'Yes' in Q24b. ↓					
c. How likely do you think it is that the Bailly Nuclear Power Plant would result in ________. Is it...					
Very likely,	1	1	1	1	1
Likely,	2	2	2	2	2
Unlikely, or	3	3	3	3	3
Very unlikely?	4	4	4	4	4
Don't know	8	8	8	8	8
d. Do you think that ________ would be...					
Very serious	1	1	1	1	1
Somewhat serious	2	2	2	2	2
Not very serious	3	3	3	3	3
Not at all serious	4	4	4	4	4
Don't know	8	8	8	8	8
e. How important was this issue in forming your opinion about the Bailly Nuclear Power Plant? Was it...					
Very important,	1	1	1	1	1
Important,	2	2	2	2	2
Unimportant, or	3	3	3	3	3
Very unimportant?	4	4	4	4	4
Don't know	8	8	8	8	8

Now we have some background questions to help us analyze the data. These questions are for classification purposes only.

22. In what year were you born? ______________

after 1956	1
1947-1956	2
1937-1946	3
1927-1936	4
1917-1926	5
before 1917	6

---

23. Are you currently......

married,	1
divorced or separated,	2
widowed,	3
never married?	4

---

24. Do you own or rent your home?

own	1
rent	2

---

25. What is the highest grade of school you have completed?

none	00
elementary	01 02 03 04 05 06 07 08
high school	09 10 11 12
college	13 14 15 16
some graduate school	17
graduate or professional degree	18
Refused	99

---

26. What is the highest grade of school most of the persons you generally talk to about local politics have completed?

none	00
elementary	01 02 03 04 05 06 07 08
high school	09 10 11 12
college	13 14 15 16
some graduate school	17
graduate or professional degree	18
don't know	68

27. Was your family income before taxes for last year, 1975 .....

more than $5,000, no....................1
more than $10,000, no....................2
more than $15,000, no....................3
more than $20,000, no....................4
more than $25,000, no....................5
more than $30,000, no....................6
yes....................7

Don't know..............................8
Refused..............................9

---

28. What would you estimate was the total family income of most of the people you generally talk to about local politics...

more than $5,000, no....................1
more than $10,000, no....................2
more than $15,000, no....................3
more than $20,000, no....................4
more than $25,000, no....................5
more than $30,000, no....................6
yes....................7

don't know..............................8
refused..............................9

---

29. What is your political preference? Are you a. . .

Republican, *(Skip to Q 30a)*..............1
Democrat, *(Skip to Q 30b)*................2
Independent,or *(Skip to Q 30c)*...........3
Something else? *(Specify)*................4
(END INTERVIEW)

Don't know, no preference *(END INTERVIEW)*8

30 a. Do you consider yourself a strong Republican or a not very strong Republican?

Strong Republican	1
Not so strong Republican	2

(END INTERVIEW)

b. Do you consider yourself a strong Democrat or a not very strong Democrat?

Strong Democrat	1
Not so strong Democrat	2

(END INTERVIEW)

c. Do you consider yourself closer to the Republican party or the Democratic party?

Republican	1
Democratic	2

(END INTERVIEW)

THANK YOU FOR YOUR COOPERATION.

Time interview ended ____________ *AM* / *PM*

Time Interview Began ____________ *am* / *pm*

Sex of Respondent: *M* *F*

Ques. ID# ________
Study # 6905
Int. ID# ________

APPENDIX G.

HERBICIDE ORANGE
CITIZEN INTERVIEW

Hello, my name is ______________, and I'm calling from Purdue University in Indiana. We are interested in how public opinion about local issues develops and changes over time, and we would like to ask you some questions about this.

If not now,
Could I call you back at ________________?

1a. From which one of the following sources do you get most of your local news... *(Circle one)*

radio, --------------------1
television, ---------------2
newspaper, ----------------3
friends, or ---------------4
some other way? -----------5
(Specify) _____________

---

b. Which one do you use least... *(Circle one)*

radio, --------------------1
television, ---------------2
newspaper, ----------------3
friends, or ---------------4
some other way? -----------5
(Specify) _____________

2a. Would you say you discuss local politics and issues with others...

all of the time, *(100%)*----5
most of the time, *(75%)*----4
some of the time, *(50%)*----3
seldom, or *(25%)*-----------2
never? *(0%) (Skip to Q 12)*-1

---

b. When discussing local politics and issues with others, would you say that you offer your opinion...

all of the time, *(100%)*------5
most of the time, *(75%)*------4
some of the time, *(50%)*------3
seldom, or *(25%)*-------------2
never? *(0%)*-----------------1

3a. During an average month, with how many different people do you discuss local politics and issues?

one--------------------------1
two--------------------------2
three------------------------3
four-------------------------4
five or more-----------------5

---

b. How frequently do you get together with these people socially? Would you say...

daily, ----------------------7
a few times a week, ---------6
once a week, ----------------5
twice a month, --------------4
once a month, ---------------3
less than once a month, or --2
never? ----------------------1

Most of us have conversations with different types of people. We'd like to know something about the people you generally talk to about local politics and issues.

4. Are most of them...

married, --------------------1
divorced or separated, ------2
widowed, or -----------------3
never married? --------------4

don't know------------------8

---

5. Are most of them the head of the household, the spouse of the head, or some other family member?

head------------------------1
spouse of the head----------2
other (Specify)-------------3

____

don't know------------------8

6. Are most of them...

male, or -------------------1
female? ---------------------2
both------------------------3

7. Do most of them own or rent their home?

own-------------------------1
rent------------------------2
both------------------------3

don't know------------------8

8. What is the highest grade of school most of them have completed?

none--------------------------------00
elementary-----01 02 03 04 05 06 07 08
high school---------------09 10 11 12
college-------------------13 14 15 16
some graduate school----------------17
graduate or professional degree-----18

don't know--------------------------88

9. Are most of them...

under 20, ------------------1
in their 20's, --------------2
30's, ----------------------3
40's, ----------------------4
50's, or -------------------5
60's or over? --------------6

10. Is the total income of most of the people you talk to...

more than $5,000? No-------1
more than $10,000? No-------2
more than $15,000? No-------3
more than $20,000? No-------4
more than $25,000? No-------5
more than $30,000? No-------6
Yes------7

don't know-------------------8
refused----------------------9

---

11. Of what race or ethnic group are most of them?

white------------------------1
American Indian--------------2
Spanish-American-------------3
black------------------------4
other (Specify)--------------5

____

Now we would like to ask you some questions concerning a local issue that you may or may not have heard about three years ago.

12. First of all, were you living in Northern Utah in 1973?

yes--------------------------1
no---------------------------2

---

13. Have you heard about the plan to dispose of a surplus weed killer, called Herbicide Orange, by burying it in Utah?

yes--------------------------1
no (skip to Q 21)------------2

14a. In what year did you first hear about Herbicide Orange?

prior to 1960----------------1
between 1960 and 1970--------2
1971-1972--------------------3
1973 ------------------------4

b. What was Herbicide Orange used for? *(Circle all that are mentioned)*

Vietnam (defoliant)----------1
agriculture------------------2
reforestation----------------3
lawn and garden--------------4
other (specify)--------------5

____

nothing----------------------6
don't know-------------------8

---

15. Did you first hear about the plan to bury Herbicide Orange in Utah through...

radio, ---------------------1
television, ----------------2
newspaper, -----------------3
friends, or ----------------4
some other source? ---------5
*(Specify)*______________

16a. Do you know where in Utah the herbicide would have been buried?

yes------------------------1
no/not sure (skip to Q 17a)--2

---

b. Where? ________________________

---

17. Which of the following do you think were involved in the decision not to go ahead with burying the herbicide in Utah? *(Read)*

	yes	no	*don't know*
a. the Federal Government?--------	1	2	8
b. the State Government?---------	1	2	8
c. the Air Force?----------------	1	2	8

18a. What __are__ your feelings about burying the herbicide in Utah? Are you...

strongly in favor, ----------1
in favor,-------------------2
opposed, or -----------------3
strongly opposed? -----------4

don't know------------------8

---

b. When you first heard about the plan, what __were__ your feelings about burying the herbicide in Utah? __Were__ you

strongly in favor, ----------1
in favor, -------------------2
opposed, or -----------------3
strongly opposed? -----------4

don't know------------------8

19a. Of the people with whom you usually talk, how many were __in favor__ of the plan to bury the herbicide in Utah? Would you say...

all, *(100%) (skip to Q 20a)*--5
most, *(75%)*------------------4
about half, *(50%)*------------3
a few, or *(25%)*--------------2
none? *(0%)*------------------1

---

b. How many were __opposed__? Would you say...

all, *(100%)*------------------5
most, *(75%)*------------------4
about half, *(50%)*------------3
a few, or *(25%)*------------- 2
none? *(0%)*------------------1

20.	damage to commercial crops	contamination of water	birth defects in animals	delayed harm to plants and animals	skin problems for people	birth defects in people	other *(Specify)*
a. What effects have you heard of that might result from burying Herbicide Orange in Utah? *(Circle all those mentioned)*	1	1	1	1	1	1	________
b. Now I'm going to read you a list of things you may or may not have heard about. This is a list of effects that some people have said might result from burying Herbicide Orange in Utah. Please stop me when I mention an issue you have heard about. *(Read issues on top of the page not mentioned in 20a)*							
yes	1	1	1	1	1	1	
no	2	2	2	2	2	2	
Ask only for those mentioned in 20a or "yes" in 20b.							
c. How likely do you think it is that burial of the herbicide would result in ________? Would you say....							
very likely,	1	1	1	1	1	1	1
likely	2	2	2	2	2	2	2
unlikely, or	3	3	3	3	3	3	3
very unlikely?	4	4	4	4	4	4	4
don't know	8	8	8	8	8	8	8
d. Do you think that ________ would be..							
very serious,	1	1	1	1	1	1	1
moderately serious,	2	2	2	2	2	2	2
somewhat serious, or	3	3	3	3	3	3	3
not at all serious?	4	4	4	4	4	4	4
don't know	8	8	8	8	8	8	8
e. How important was this issue in forming your opinion? Was it...							
very important,	1	1	1	1	1	1	1
somewhat important,	2	2	2	2	2	2	2
not very important, or	3	3	3	3	3	3	3
not at all important?	4	4	4	4	4	4	4
don't know	8	8	8	8	8	8	8

21. Some people have suggested that the herbicide should be used rather than destroyed. How do you feel about this suggestion? Are you...

strongly opposed, -----------1
opposed, --------------------2
in favor, or ----------------3
strongly in favor? ----------4

don't know-------------------8

---

22. Now I'm going to read you the names of groups that may or may not have some authority to make decisions such as deciding to dispose of a herbicide. Please tell me how much authority each group should have in making decisions of this kind.

	a great deal of authority	a moderate amount of authority	a little authority	no authority at all	*don't know*
a. The Federal Government in Washington? Should it have...	1	2	3	4	8
b. The State Government? Should it have...	1	2	3	4	8
c. Scientists and other experts? Should they have...	1	2	3	4	8
d. Citizens in the local community? Should they have...	1	2	3	4	8

Now we have some background questions to help us analyze the data.

23. Have you ever used a herbicide to kill weeds?

yes--------------------------1
no (skip to Q 24a)-----------2

---

b. Did you use it...

	yes	no
on your lawn? ---------------	1	2
on your garden? -------------	1	2
on your farm? ---------------	1	2
on pastureland? -------------	1	2
anywhere else? *(Specify)*-----	1	2

____

24a. Do you know what this particular weed killer, Herbicide Orange, is made of?

yes---------------------------1
no (skip to Q 25)------------2

---

b. What? ______________

2,4-D, 2,4,5-T, dioxin-------1
2,4-D------------------------2
2,4,5-T----------------------3
dioxin-----------------------4
other (Specify)--------------5
____

---

25. In what year were you born? _________________

after 1956------------------1
194[illegible]------------------2
[illegible]------------------3
[illegible] 1936------------------4
[illegible]-1926------------------5
[illegible]------------------6

---

26. Are you currently...

married, -------------------1
divorced or separated, ------2
widowed, or -----------------3
never married? --------------4

---

27. Do you own or rent your home?

own--------------------------1
rent-------------------------2

28. **What is the highest grade of school you have completed?**

none--------------------------------00
elementary-----01 02 03 04 05 06 07 08
high school----------------09 10 11 12
college--------------------13 14 15 16
some graduate school----------------17
graduate or professional degree-----18

refused-----------------------------99

---

29. **Was your total family income before taxes for last year, 1975...**

more than $5,000?   No-------1
more than $10,000? No-------2
more than $15,000? No-------3
more than $20,000? No-------4
more than $25,000? No-------5
more than $30,000? No-------6
Yes------7

don't know-------------------8
refused----------------------9

---

30. **What is your political preference? Are you a...**

Republican, *(skip to Q 31a)*------1
Democrat, *(skip to Q 31b)*--------2
Independent, or *(skip to Q 31c)*--3
something else? *(Specify)*--------4
(End Interview)

31a. **Do you consider yourself a strong Republican or a not very strong Republican?**

strong Republican------------1
not so strong Republican-----2
(End Interview)

b. Do you consider yourself a strong Democrat or a not very strong Democrat?

strong Democrat--------------1
not so strong Democrat-------2

---

c. Do you consider yourself closer to the Republican party or the Democratic party?

Republican-------------------1
Democratic-------------------2
(End Interview)

THANK YOU FOR YOUR COOPERATION

Time interview ended ________________ *am* / *pm*

PURDUE UNIVERSITY
DEPARTMENT OF POLITICAL SCIENCE
WEST LAFAYETTE, INDIANA 47907

PROGRAM IN SCIENCE, TECHNOLOGY
AND PUBLIC POLICY

APPENDIX H.

MAILED QUESTIONNAIRE AND COVER LETTER USED FOR SOME DIRECT PARTICIPANTS IN THE WATER CASE STUDY

I am one of the four researchers at Purdue University engaged in a project sponsored by the Office of Water Research and Technology, U.S. Department of the Interior. One purpose of our research is to gain a better understanding of decisions and choices about the quality of drinking water in the United States.

My colleagues and I have noted your interest in public water supplies, through your testimony in hearings on the federal Safe Drinking Water Act. We would like to prevail upon you to fill out the enclosed questionnaire and return it in the envelope provided.

Questions on the form are of two types:

1. Open-ended. Where the question is followed only by blank space for your response, we are interested in getting your views in your own words. Some of these questions ask for your personal views and others for the views of your group or organization. In both cases, please feel free to add material which may not be directly germane to the question. The more complete and candid your response, the more helpful it will be.

2. Scaled. Several questions provide a scale to be checked or numbered. So that your response may be compared with the responses of others, it is very important that you mark the scales. But do not hesitate to amplify your response in the margins or on the back of the page. Anything you write on the form will be read very carefully.

In addition to the completed questionnaire, please send a copy of any materials you or your group or organization might at any time have prepared, on drinking water. Send the materials at our expense, of course.

My colleagues and I are very grateful for your interest and your willingness to take time from a busy schedule to complete the form.

Sincerely,

Heather Johnston Nicholson

Heather Johnston Nicholson, Ph.D.
Assistant Professor

Enclosures
HJN:bmm

APPENDIX H, continued

Questionnaire
Drinking Water and Public Water Supplies

1. Your name ______________________________

2. Please list any organizations in which you have participated or are now participating that have expressed a position on quality of drinking water or on regulation of public water supplies.

	Organization	Dates of your Participation
a.	____	19__ to 19__
b.	____	19__ to 19__
c.	____	19__ to 19__
d.	____	19__ to 19__

3. How did your interest in the issue of drinking water quality come about? Can you describe the process?

4. Did you testify at the Congressional hearings on the Safe Drinking Water Act in 1973? If so, did you represent an organization when testifying? What organization? Or how did it happen that you gave testimony?

If you represented or now represent an organization, please continue with question #4. If you did not and do not represent an organization, please proceed to question #5.

a. How did this organization become involved with drinking water quality? Can you describe the process?

b. What are the goals, positions and concerns of this organization about the quality of water in public water supplies?

c. How did it come about that a representative of the organization gave testimony on the Safe Drinking Water Act in 1973?

d. Does this organization have state and/or local chapters? If so, how many?

____

e. What is the total national membership of this organization?

____

f. Are there any requirements to be a member of this organization? If so, what?

____

g. Some people feel that an organization is most effective in accomplishing its goals if most of the decisions are made by the leaders. Others feel that people at all levels and degrees of commitment should be involved in decision-making. How would you characterize the process of decision-making about the quality of drinking water, in the organization?

h. Can you describe the general structure of leadership if the organization? For example, is there a Board of Directors, Chairman, President? Are leaders elected, or committed volunteers, or just how do they gain positions of leadership?

i. How long have you been a member of this organization? ________________

j. Generally speaking, what methods (lobbying, preparing literature...) are used to accomplish the goals of the organization? Are these methods the same for goals about the quality of drinking water or public water supplies, and for any other issues in which the organization is involved? Can you give some examples?

k. Generally speaking, how are the funds obtained for implementing the goals of the organization or public issues? On quality of drinking water or regulation of public water supplies? ______________________________________

____

1. Has the organization taken a position on public participation in decisions about the quality of drinking water? Do the members of the organization consider it advisable or important that the public participate in setting and implementing standards for the quality of drinking water? Or not advisable or important? Or just what?

5. How did it come that you as an individual testified at the hearings on the Safe Drinking Water Act? Can you describe the process?

6. Listed below are the organizations and individuals who testified on the Safe Drinking Water Act in 1973. Please indicate those with whom you have had direct or indirect contact; and note the nature of any interaction concerning drinking water or public water supplies? Do these individuals or groups share, or not share, your position on the issues?

____National Water Supply Improvement Association ____________________

____The Honorable Howard W. Robinson, U.S. Representative, New York ________

____The Honorable Walter D. Huddleston, U.S. Senator, Kentucky __________

____National League of Women Voters ____________________

____National Water Well Association ____________________

____National Association of Water Companies ____________________

____American Water Works Association ____________________

____American Academy of Environmental Engineers ____________________

____Natural Resources Defense Council ____________________

____Conference of State Sanitary Engineers ____________________

____Center for the Study of Responsive Law (Mr. Ralph Nader) ____________

____Cornell University (Dr. Leonard Dworsky, Water Resources Department)______

____Kentucky Department of Health, Division of Sanitary Engineering ______

____Dartmouth Medical School (Dr. Henry A. Schroeder, Physiology) ______

____Environmental Protection Agency ______

____University of Maryland, (Mr. Robert Harrison, Environmental Engineering)___

7. Are there any other groups or organizations, including governmental agencies, with whom you have had direct or indirect contact concerning drinking water or public water supplies? If so, please list these below, noting briefly the nature of the interaction. Do these groups or organizations share, or not share your position on the issues?

Group, Organization, etc. Nature of Contact & Position on Issues

a. ______

b. ______

c. ______

d. ______

e. ______

8. The issue of drinking water quality is multi-faceted and complex. What do you think are the important aspects of drinking water quality? What are your positions regarding these aspects?

9. Have these positions changed since your initial contact and understanding concerning drinking water quality? Since the 1973 SDWA hearings? If so, how?

10. Some people might argue that the important aspects of drinking water quality include cost, technical considerations, risk, public input and participation, enforcement, and testing problems. These six aspects are listed and illustrated below. Please give a "1" to the most important, a "2" to the second most important and so on to "6". If you believe one of the six aspects is not important, please mark it with an "x".

____Cost (For example, the cost of implementation of the drinking water standards and/or financial assistance needed for research)

____Technical considerations (For example, personnel availability; the training and certification of water suppliers and testors; and the collection, surveillance and testing of samples)

____Risk (For example, risk of human illness or death due to contamination of the public water supply)

____Public input and participation (For example, what the public should know; who should tell them and what the public's role should be in setting and implementing standards of water quality)

____Enforcement (For example, by what means standards should be enforced; whether enforcement should be governmental or not; at what level (local, state, national) enforcement should occur)

____Testing problems (For example, what possible contaminants to test for; what is acceptable drinking water; what can be "safely" left in the public water supply)

11. Some people say the Federal Government should be highly involved in setting drinking water standards, while others feel that this should be done at the state and local level. What is your opinion?

12. Do you personally think that there is any likelihood of dangerous contamination of a public water supply in the United States?

13. Many people have encountered situations where they were warned not to drink the public water supply, especially in foreign countries. Can you recall any instances during your connection with the issue of drinking water quality in which a public water supply (either in a foreign country or here in the United States) was not fit for public consumption? If so, could you briefly explain the situation and the cause of the "unsafe" drinking water supply?

14. What do you think are the most important factors in deciding what to test for in public water supplies? Of the things you've mentioned, what do you think is the most important?

15. What do you think are the most important factors in deciding how often to test for particular substances in public water supplies? Of the things you've mentioned, what do you think is the most important?

16. Below is a list of items which may or may not be important in deciding what to test for and how often to test public water supplies. Please rank these factors, giving the most important a "1", the second a "2", etc. If you feel any factors are irrevelant and should not be considered, please mark them with an "x".

____Size of population of community consuming the water
____Time required for analysis
____Available resources including technicians to carry out tests
____Cost of analysis
____Immediate consequences of not testing
____Long-term consequences of not testing
____Number of samples required for comprehensive testing
____Accuracy of available tests
____Federal regulations and guidelines (presently)
____Other (please specify)

17. Below is a list of items that may be found in a drinking water supply. Please rank them with respect to how important you feel it is to test for them. Give a "1" to the item for which it is most important to test, a "2" to the second most important item, etc.

____Harmful viruses
____Pesticides
____Odor-causing substances
____Harmful bacteria
____Heavy Metals
____Inorganic toxins (cyanide,etc.)
____Murkiness
____Radioactive substances
____Other (please specify)

18. Please rank the items below with respect to the likelihood of their occurrence at unacceptable levels in a public water supply. Give the item most likely to occur a "1", the second most probable item a "2", etc.

____Harmful viruses
____Pesticides
____Odor-causing substances
____Harmful bacteria
____Heavy Metals
____Inorganic toxins (cyanide, etc.)
____Murkiness
____Radioactive substances
____Other (please specify)

19. Please rank the items below with respect to likelihood of a serious illness of death in humans occurring due to that particular item. Give a "1" to the item considered most likely to cause such an event, etc.

____Harmful viruses
____Pesticides
____Odor-causing substances
____Harmful bacteria
____Inorganic toxins (cyanide, etc.)
____Murkiness
____Radioactive substances
____Other (please specify)
____Heavy Metals

20. According to the new guidelines in the Safe Drinking Water Act, the public must be informed by the water supplier of any non-compliance with the standards. Do you feel this is a good policy? If so, why? If not, why not?

21. What do you feel is the role, if any, that the general public or organized groups of citizens should play in establishing what to test for and how often to test public water supplies?

22. What is the role that interest groups should play in the decision-making process and the implementation of the standards with regard to drinking water quality?

23. Is there anything else about the quality of drinking water, or about you or your organization, that we should know or that you would like to tell us?

APPENDIX I.

PRELIMINARY CODEBOOK FROM THE WATER CASE STUDY WITH A SAMPLE CODE SHEET FOR DATA.

Analyzing Social Choice About Technology
Concerning Water Resources

Case Study: Quality of Drinking Water

CODEBOOK FOR INTERVIEWS WITH DIRECT PARTICIPANTS

CARD I Columns	RECORD CARD # IN COL 80 Card #1	Form*	Question
1-3	Study Number 690		
4	Case Study Identifier		
	[✓ 1.] Drinking Water Case Study		
	3. Herbicide Case Study		
	5. Power Plant Case Study		
5-7	Respondent's Identification Number		
	[✓ 100-199.] Elite Interview		
	201-299. Mailed Questionnaire		
	301-699. Population Sample		
8-10	Title of occupation or position	E	2
	related to Drinking Water (DW)	(M	6)
	or Water Supply (WS)		
	See Master Code 1 for exact coding		
	100-199. Government		
	200-299. Interest group member or rep.		
	300-399. Expert		
	700-799. Citizen (P form only)		
11	Source of water supply		
	1. Ground water (Laf, W. Laf)	Interviewer supplies	
	2. Surface water (Indianapolis)	on face sheet.	
	9. Not Applicable, No Response		

*Form:	E=Elite Interview (Direct Participant)	M=Mailed Questionnaire (Testified on Safe Drinking Water Act)	P=Population Sample (Citizens, i.e. affected groups)

CARD I   RECORD CARD # IN COL. 80 Card=1

Columns		Form	Question
12	Length of time in present organization 1. Less than 1 year 2. 1-3 years 3. 4-6 years 4. 7-9 years 5. 10 years or more 9. Not Applicable (NA), No Response (NR)	E (M	5 11)
13	Length of time in present position within organization (Column 12) 1. less than 1 year 2. 1-3 years 3. 4-6 years 4. 7-9 years 5. 10 years or more 9. NA, NR	E (M	5 12)
14	Present job is 1. Elected 2. Appointed 3. Civil Service 4. Private hiring 9. Not Applicable, NR	E	6
15	Has Respondent (R) a role in making decisions about standards for WS? 1. Yes, has a direct role 2. Yes, role is indirect, tangential, etc. 3. Yes, R does not answer directly but seems to have a role 4. No, R does not answer directly but seems to have no role 5. No, R is fairly certain of having no role. 6. No, R categorically denies having role. 8. R responds; unable to code: See transcript. 9. NA, NR	E	7

CARD I RECORD CARD # IN COL 80 Card=1

Columns		Form	Question
16	Has R a role in implementing or enforcing decisions about WS? (response categories same for col. 15: see for complete code) 1. Yes, direct 2. Yes, indirect 3. Yes, seems to 4. No, seems not to 5. No, probably none 6. No, definitely none 8. Response not coded 9. NA, NR	E	8
	Who makes decisions about standards for Water Quality in Indiana? SEE MASTER CODE 2: Decision-makers on Standards & Enforcement	E	9
17-18	Decision-maker R mentions (first)		
19-20	Decision-maker R mentions (second)		
21-22	Decision-maker R mentions (third)		
23-24	Decision-maker R mentions (fourth) (Code all others at CARD II, Cols. 48-70, in 2-column fields. See codebook, page)		
25	Record the number of decision-makers mentioned by R 1. One decision-maker mentioned 2. Two 3. Three 4. Four 5. Five 6. Six 7. Seven 8. Eight or more 0. R mentions no decision-makers and 9. NA, NR R was asked	E	9

.........and so on to the end of card 1.

Drinking Water Case Study   Elite Interviews

CARD II   RECORD CARD # IN COL 80 Card=2

Columns		Form	Question
1-3	Study Number 690		
4	1. Drinking Water Case Study		
5-7	Respondent's Identification Number 100-199. Elite interview ID Numbers		
	Please rank factors important in determining testing schedule (what to test for & how often to test)	E (M (P	27 23) __)

CODING FOR COLUMNS 8-16:
Record actual rank, in 1-col. field, as below.

1. Rank One assigned by R
2. Rank 2
3. Rank 3
4. Rank 4
5. Rank 6
7. Rank 7
8. Rank 8
0. X assigned by R - feels not important
9. NA, NR

Columns		Form	Question
8	Time required for analysis	E (M	27a 23a)
9	Cost of analysis	E	27b
10	Immediate consequances of not testing	E	27c
11	Long-term consequences of not testing	E	27d
12	Number of samples required for comprehensive testing	E	27e
13	Available resources to carry out tests	E	27f

CARD II RECORD CARD # IN COL 80 Card=2

Columns		Form	Question
	Rank factors important in determining testing schedule, continued	E (M (P	27 23) __)
14	Accuracy of available tests	E	27g
15	Federal standards and guidelines (presently)	E	27h
16	Other	E	27i
17	Other factor mentioned by R in response to E 27i, and ranked at column 16 1. Source from which water was taken 2. Consumer reaction to quality of water 3. State standards and guidelines 4. 5. 6. 0. R ranked alternatives without offering "other" 9. NA, NR		

.... and so on through CARD II

MASTER CODE 1: Occupation or Position Related to Water Resources

USE FOR CODING OCCUPATION OR POSITION OF:

E=Elite Interviews	100-699 only - from E 2
M=Mailed Quest.	100-699 only - from M 6
P=Population Sample	700-799 only - from P _

100-199 Government

100-129 Local or Regional Government

100 Mayor
101 Director, Municipally owned water works
103

130-149 State Government

130 Governor
131 State lab manager

140 Director, State Dept. of Health
141 Director, Division of Water Supply, State Board of Health

150-169 U. S. Government

200-299 Interest Group Member or Representative

200-229 Professional Association

226 Indiana Association of Water Supply Engineers, Executive Secretary & Lobbyist
699 Occupations or position not known and not able to be inferred from other questions: E and M forms only
799 Occupation not known: P form only

MASTER CODE 2: Decision Makers on Standards, Implementation, Enforcement

Local Government

01 Local governments, not specified

State Government

11 State of Indiana, not specified
12 Director, State Board of Health
13 State legislature
14 State legislative committees
15 State legislators, specified by name or position

17 Governor

U.S. Government

21 Environmental Protection Agency
22 Council on Environmental Quality
23 Congress
24 Congresstional committees
25 Congressmen, Senators, specified by name or position

27 President

Interest Groups
Professional groups, consultants, experts
Other (specify)
81

99 NA, NR

Example of Codesheet Drinking Water Case Study Elite Interview

				5					10					15					20						80
6	9	0	1	1	0	0	1	3	0	9	2	2	2	5	2	2	1	1	2	1	3	9	9	3	1
6	9	0	1	1	0	1	2	2	8	9	4	2	1	2	3	1	2	2	2	4	1	1	3	6	1
6	9	0	1	1	0	2																			1
6	9	0	1	1	0	0	3	4	1	2	5	6	7	8	9	9									2
6	9	0	1	1	0	1	4	6	3	1	2	7	5	9	8	3									2
6	9	0	1	1	0	2																			2

DRINKING WATER CODEBOOK

Card 1

Columns

1-3 Study number 690

4 Case study identifier--1

5-7 Respondent's identification number

8 Source of water supply
  1. ground water (Laf, W. Laf)
  2. surface water (Indianapolis)
  3. R deals with both (state, fed official)
  8. NA/NA

9 Length of time in present organization
  1. less than 1 year
  2. 1-3 years
  3. 4-6 years
  4. 7-9 years
  5. 10 years or more
  8. NA/NA

10 Length of time in present position within organization same as above

11 Present job is:
  1. elected
  2. appointed
  3. merit civil service
  4. employed by private firm or utility
  5. commissioned officer
  8. NA/NA

12 Has R a role in making decisions about standards for WS?
  1. yes-direct
  2. yes-indirect
  3. yes-R does not answer but seems to have a role
  4. no-R does not answer but seems to have a role
  5. no-R is fairly certain of having no role
  6. no-R denies having a role
  7. RDK
  8. NA/NA
  9. REF

Card 1

Columns

13 Has R a role in implementing or enforcing decisions about WS? same as question no. 12.

14-25 Who makes decisions about standards for water quality in Indiana?
  14-16 first decision maker mentioned
  17-19 second decision maker mentioned
  20-22 third decision maker mentioned
  23-25 fourth decision maker mentioned

26 Number of decision makers mentioned
  1. one
  2. two
  3. three
  4. four
  5. five
  6. six or more
  7. RDK
  8. NA/NA
  9. REF

27 How does community feel about kind of water service?
  1. all satisfied
  2. most satisfied
  3. few satisfied
  4. none satisfied
  7. RDK
  8. NA/NA
  9. REF

28 Community view of overall quality of water
  1. excellent
  2. adequate
  3. less than adequate
  4. poor
  7. RDK
  8. NA/NA
  9. REF

Card 1

Columns	
29-43	What groups in community or state are interested in quality of water? 29-31 group mentioned first 32-34 group mentioned second 35-37 group mentioned third 38-40 group mentioned fourth 40-43 group mentioned fifth
44-48	Character of relation for each group in above 1. positive 2. neutral 3. negative 7. RDK 8. NA/NA 9. REF
49-63	Groups in the state or community that have direct bearing on water quality. 49-51 group mentioned first 52-54 group mentioned second 55-57 group mentioned third 58-60 group mentioned fourth 61-63 group mentioned fifth
64-68	Character of relation for each group above 1. positive 2. neutral 3. negative 7. RDK 8. NA/NA 9. REF

Begin Card 2

Columns	
1-7	Identifier number (6901)
8-22	What major institutions directly or indirectly involved in quality of public water supplies? 8-10 first mentioned 11-13 second mentioned 14-16 third mentioned 17-19 fourth mentioned 20-22 fifth mentioned
23-27	Character of relations with institutions mentioned above. 1. positive 2. neutral 3. negative 7. RDK 8. NA/NA
28	Has R's agency responsibility for giving information to citizens? 1. clear obligation, whether solicited or not. Agency has active role. 2. Information in response to question. Passive role 3. Minimal responsibility 7. RDK 8. NA/NA
29	Has R's agency responsibility for getting/soliciting/listening to views of citizens? 1. Clear obligation to solicit views. Active role. 2. Obligation to listen/respond to views. Passive role. 3. Minimal role in listening to citizen views. 4. No responsibility. 7. RDK 8. NA/NA

Card 2

Columns

30 R's characterization of information/competence of public
  1. citizens informed
  2. citizens marginally/minimally informed
  3. citizens uninformed
  7. RDK
  8. NA/NA

31 R's attitude toward citizens; R's role toward citizens
  1. R sees self as servant/helper of citizens. Active role.
  2. R sees self as responder to citizen demand. Passive role.
  3. R sees citizens as (mild) constraint to effective functioning
  4. R sees citizens as hampering functioning; seems hostile.
  7. RDK
  8. NA/NA

32 Is R aware of Safe Drinking Water Act?
  1. Yes-R seems knowledgeable
  2. Yes-R states knowledge without elaboration or is hesitant
  3. No- states no knowledge
  8. NA/NA

33 Is R aware of EPA standards to be implemented under the SDW Act?
same as above

34 Does R think it will be feasible to implement?
  1. Yes-immediately
  2. Yes-gradually or with qualification
  3. No-not feasible
  7. RDK
  8. NA/NA

35 Should federal government be involved in setting drinking water standards?
  1. Yes-primary with enforcement responsibility
  2. Yes-advisory with no enforcement
  3. No-no direct role or very limited role
  7. RDK
  8. NA/NA

Card 2

Columns

36 Should state government be involved?
same as question #35.

37 Should local government be involved?
same as question #36.

38 Does R know what standards are implemented/enforced in Indiana?
  1. Yes-R seems knowledgeable
  2. Yes-R states knowledge without elaboration or is hesitant
  3. No-no knowledge is stated.
  8. NA/NA

39 Are Indiana standards the same for all sources of water?
  1. yes
  3. no-different for different sources
  7. RDK
  8. NA/NA

In lab with which R is most directly associated are specific tests carried out for:

40	biological contaminants	0=no
41	chemical contaminants	1=yes
42	pleasantness	7=RDK
43	physical properties	8=NA/NA
44-45	other	

46 Do lab personnel understand testing schedule and its importance?
  1. yes
  2. most, but not all
  3. no
  7. RDK
  8. NA/NA

47 Are policies toward testing well known to lab personnel?
same as above.

48 Is there consensus or disagreement among lab personnel on what tests to apply?
  1. Consensus
  3. At least some occasional disagreement
  7. RDK
  8. NA/NA

Card 2 7

Columns	
49	Who interprets testing schedule to lab personnel? 1. technically trained supervisor 2. other lab technicians 3. administrative supervisor (not technically trained) 4. no one-teaches self 7. RDK 8. NA/NA 9. REF
50-59	What are most important factors in deciding what to test for? 50-51 most important 52-53 next important 54-55 next important 56-57 next important 58-59 next important
60	Number of factors mentioned as important in deciding 1. one 2. two 3. three 4. four 5. five 6. six or more 7. RDK 8. NA/NA 9. REF
61-70	What are most important factors in deciding how often to test? 61-62 most important 63-64 next important 65-66 next important 67-68 next important 69-70 next important
71	Number of factors mentioned in deciding how often to test , same as in colume 60
72	How much does testing schedule change? 1. from month to month or more often 2. from one year to the next 3. some change within five years 4. less than five years

Card 2 8

columns	
72	7. RDK 8. NA/NA 9. REF
73-78	Tests R mentioned as having changed 73-74 first test mentioned 75-76 second test mentioned 77-78 third test mentioned

Begin card 3

1-7 Identifier number (1901)

8-13 Tests R mentioned as not having changed
8-9 first test mentioned
10-11 second test mentioned
12-13 third test mentioned

14 How has testing schedule come into use?
1. federal standards
2. state standards
3. local or water company standards
4. combination of fed and state
7. RDK
8. NA/NA

15 Do you personally think there is any likelihood of dangerous contamination of public water supplies in Indiana?
1. yes-some likelihood
2. yes-very slight chance
3. no
7. RDK
8. NA/NA
9. REF

16 Likelihood of contamination of public water supplies in area which R is most familiar.
same as above.

17 Does R think public perceives likelihood of contamination in Indiana?
same as above.

18 Does R think public perceives likelihood of contamination in area which R is most familiar?
same as above.

25-34 Rank factors from blue card - factors important in determining testing schedule.
25. Size of population
26. time required
27. available resources
28. cost of analysis
29. immediate consequences
30. long term consequences
31. number of samples
32. accuracy of available
33. federal regulations
34. other

Card 3

35-43 Rank factors from green card - most likely to occur at unacceptable levels.
35. harmful viruses
36. pesticides
37. odor-causing substances
38. harmful bacteria
39. heavy metals
40. inorganic toxins
41. murkiness
42. radioactive substances
43. other

44-52 Rank factors from orange card
44. harmful viruses
45. pesticides
46. odor-causing substances
47. harmful bacteria
48. heavy metals
49. inorganic toxins
50. radioactive substances
51. murkiness
52. other

53-61 Rank factors from pink card
53. harmful viruses
54. pesticides
55. odor-causing substances
56. harmful bacteria
57. heavy metals
58. inorganic toxins
59. murkiness
60. radioactive substances
61. other

* * * * * * * * * * * * * *

MASTER CODE 1

First digit	Second digit	Third digit
0 unspecified	0 unspecified	
1 local	1 government	
2 interstate regional	2 government	
3 state	3 government	
5 interstate regional	4 corporation	
7 federal	5 media	
	6 interest group	
	7 interest group	
	8 expert/professional	
	9 expert/professional	

* * * * * * * * * * * * * *

MASTER CODE 2

Environmental factors:	Additive factors:	Research factors:
10 type of water	30 alkalinity	50 current level of research
11 upstream discharges	31 detergents, phosphates	51 personnel
12 seasonal	32 arsenic	
13 temperature	33 lead	
14 size of population	34 mercury	
15 catastrophies	35 nitrates	
16 quality of water	36 hardness	
17 appearance	37 harmful bacteria	
18 health effects		
19 likelihood of contamination		
20 quality of operations		

* * * * * * * * * * * * * *

MASTER CODE 1

First digit	Second digit	Third digit
0=unspecified	0=unspecified	
1=local	1=government	
2=intrastate regional	2=government	
3=state	3=government	
4=	4=corporation	
5=interstate regional	5=media	
6=	6=interest groups	
7=federal	7=interest groups	
	8=expert/professional	
	9=expert/professional	

* * * * * * * * * * * * * *

CODE 2- ELITES INTERVIEWED

111- Ed Deboer
112- Angelo Palikaris
113- Georgia Long
146- Joseph A. Roush, Jr.
147- John Yost
141- R. J. Becker
145- Thomas Moses
312- Leland Dyke
131- Joan Boersig
314- Neal Ott
315- Robin Middleton
723- Lawrence Gray
724- Joseph Cotruvo
725- Victor Kin
726- Kenneth MacKenthun
727- Jim McDermott
728- Jeffrey Miller
729- GAO Staff
782- Federick Allen
783- George Symons

CODE 3- INSTITUTIONS CITED

110- Local government unspecified
111- Local politicians
113- Lafayette Water Company
114- Local Board of Health
140- Local industry unspecified
141- Indianapolis Water Company
180- Water supply operators
181- Local water company groups
212- Hoosier Heartland
213- Citizens Energy Coalition
214- Regional planning districts
215- County health officers
310- State government-unspecified
311- State Board of Health
312- State Laboratory
313- Sanitary Engineers Division
314- State politicians
315- State Water Works supervisor
316- Water division
317- University research groups
361- Indiana Public Interest Research Group
380- State associations of water companies
381- Indiana Society of Professional Engineers
511- County health officers
561- American Medical Association
581- Great Lakes Upper Mississippi River Board of State Sanitary Engineers
710- Federal government unspecified
711- Federal health authorities
712- EPA
713- AEC (name has changed)
714- Criteria and Standards Division in Office of - Water Supply, EPA
715- FDA
716- EPA, Region 5
717- EPA Regionals unspecified
721- Water Supply and Research Division (Environmental - Research Laboratory, Cincinnati)
730- Federal public hearings
770- Environmental groups unspecified
771- Izzak Walton League
772- Environmental Defense Fund
773- League of Womens Voters, US
774- International Ozone Institute
775- Natural Resources Defense Council
776- National Wildlife Foundation
777- Cornell Water Resource Center
780- National associations of water companies unspecified

CODE 3- INSTITUTIONS CITED

781- American Water Works Association
782- National Safe Drinking Water Council
783- Conference of State Sanitary Engineering
784- National Water Supply Improvement Assn.
785- National Water Well Assn.
786- American Academy of Environmental Eng.

TELEPHONE INTERVIEWER'S INSTRUCTIONS

The Institute of Science, Technology, and Public Policy at Purdue University is presently at work on a project sponsored by the U. S. Department of Interior. The TELEPHONE SURVEY, one phase of the project, has been designed to clarify public opinion regarding each of the three different case studies involved.

General Procedure

The TELEPHONE SURVEY consists of a structured and detailed interview schedule which is to be read over the telephone to a random selection of the population in each of the communities cited for study. Each interviewer is responsible for obtaining the information solicited on the particular interview schedule. A list of these names and telephone numbers will be made available to you. Each interviewer is to call these names in order while noting the information requested for the survey, i.e. call back, refusal, etc. The specific directions for each question will accompany the interview schedule.

Your Role in the Interview: Approaching the Telephone

Undoubtedly we have all spent countless hours on the telephone. However, hours questioning new and unfamiliar voices places a different set of demands upon you as an interviewer. The following suggestions have been developed to serve as guidelines for your telephone interviewing.

1. BE MENTALLY AND PHYSICALLY PREPARED TO SPEAK.

a. Atmosphere--When approaching members of the public, it is important to create a "warm" atmosphere since this is a basic condition for a higher level of respondent cooperation.

b. Attitude--In order to foster this kind of atmosphere, it is important for the interviewer to show an interest in the project, to suggest a seriousness of purpose, and to remain fresh and positive in outlook.

c. Voice--The interviewees won't be able to see you, but they can surely hear you. Your voice must be clear as well as strong enough so that they may hear your questions with ease. Your speaking rate must be appropriate.

2. THINK ABOUT THE INTERVIEW

a. Most of us probably do not enjoy being read to for 15 minutes. Try to know and understand the questions before you get on the phone. This will also aid you when it becomes necessary to probe for an answer.

b. Be as accurate and concise as possible in your note taking on the open-ended questions.

3. LISTEN FOR MAIN POINTS

a. Language fluency and clarity will not be possessed by everyone you call. It may also be difficult for some people to understand your question immediately. Be patient, repeat, or clarify if necessary. However, DO NOT REVEAL THE SET OF ANSWERS unless otherwise instructed.

b. When the interview is over, state your appreciation of the interviewee's time and effort. Again, brevity is important.

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BAILLY NUCLEAR POWER PLANT

CITIZEN INTERVIEW

INSTRUCTIONS FOR INTERVIEWERS:

First here is some general information for using the interview schedule.

You will be assigned a number, your "interviewer number", so that we can tell who actually did the interview. This number should be put on the bottom line in the box at the top of the first page of the schedule, for each interview you do.

Fill in the first and second lines in that box from the form that tells you whom to call. The "study number" is listed at the top of the form with names on it. And the "Question #" is the number listed at the left of each name on the list. Put the number of the person you are calling in the appropriate space in the box at the top of the first page of the interview schedule. Just in case the pages get separated, please put the same number in the upper right hand corner of each page of the interview schedule.

When you get a person on the phone, write down the time that the interview began. Also circle the sex of the person you are interviewing.

Now you are ready to do the interview. In reading through the interview schedule, you'll notice that there are two general kinds of questions. One kind ends with dots (.....) while the other kind ends in a question mark (?). These different endings are a cue for you to know whether or not to read the answer choices.

When the question ends with dots (....), you should read the answer choices slowly to the respondent. For example, question 1a. ends in .... Therefore you ask "From which of the following sources do you get most of your local news, radio, television, newspaper, friends, or some other way?" And then you circle the number opposite the answer the respondent gives you.

When the question ends in a question mark (?), you do not read the answer choices. Let the respondent answer and then circle the number opposite the answer the respondent gives you. An example of this type of question is Q. 3a. You ask "During an average month, with how many different people do you discuss local politics and issues?" And then you wait for the respondent to give you an answer and circle the number opposite from the answer. The interview schedule is set up so that all possible answers that the respondent could give you are included in the list of answers.

Regardless of how the question ends, in dots or a question mark, you never read a "Don't know" answer choice. Let the respondent tell you he/she doesn't know, but don't provide him/her with that option.

Sometimes an answer choice will be "Other (specify)" with a line under it. Here you need to circle the number opposite "Other" and write in the blank as nearly as possible what the respondent has said, shortening it to a few words if the short form would be clear to someone who has not heard the conversation.

You'll also notice that there are statements to be read to the respondent from time to time that are not part of specific questions. Some examples are before Q.1. and before Q. 4. These statements signal that we are changing topics or changing the form of the question. Until you are familiar with the interview schedule, these statements may be easy to miss; so be sure to look for them the first few times.

Throughout the interview schedule there are some instructions that should be called to your attention. Some examples of these instructions are "circle one", "specify", "skip to Q. 12", etc. These instructions are particularly important on the large tables in Q. 24 and Q. 25, so you should become familiar with them.

Some last general comments. Please be sure to stress any words or phrases that are underlined. These are the words that are particularly important and therefore they should be emphasized. For example, in Q. 1a, we are interested in the source from which people get most of their local news; it may be quite different from the source of national news.

Now we have some instructions about individual questions. Some of these instructions may seem a little repetitious, but as you go through these instructions you'll know how to handle each question.

Q. 1a. Stress the underlined words. Read the answer choices. Only one answer is desired, is possible. If the respondent cannot decide between two, circle both mentions only after you have sufficiently probed for one answer. If the respondent (R) cannot decide between 2 or more sources, try to ask Q. 1b. which will eliminate one answer category; then perhaps it will be easier for R to choose one answer for Q. 1a. If "Some other Way", specify on the line provided.

Q. 1b. Same as Q. 1a.

Q. 2a. Stress the underlined word. Be sure to read the answer choices. The percentage in parenthesis for for the interviewer's use in case R responds in terms of percentage rather than the categories offered. If "Never", skip to Q. 12.

Q. 2b. Same as Q. 2a. Note, however, that there is no skip pattern.

Q. 3a. Do not read the answer choices.

Q. 3b. Read all the answer choices slowly, since there are several R has to remember.

Q. 4. Read the answer choices. If more than one choice is mentioned, probe to determine what the status is of most of the people with whom R talks. If this is impossible, circle all that are mentioned. If this happens, try to restrict this to no more than two choices.

Q. 5. Do not read the answer choices. You've already included them in your question.

Q. 6. Read "Male or female", but not "Both". Circle "both" if R says both.

Q. 7. Do not read the answer choices.

Q. 8. Do not read the answer choices. If R gives a general answer, such as "High school", probe for the specific grade in high school.

Q. 9. Read the answer choices. If more than one choice is mentioned, probe to determine what the age is of most of the people with whom R talks. If this is impossible, circle all that are mentioned. If this happens, try to restrict this to no more than two choices.

Q. 10. Read the answer choices slowly. Circle the level at which you get a "No" answer.

Q. 11. Do not read the answer choices. Mark the "Other" category if R mentions a year before 1965 and indicate what year the R mentions.

Q.15a. Code "1" should be circled even if R only thinks he/she knows where the Bailly Nuclear Power Plant would have been located. If the answer is "No" or "Not sure", skip to Q. 16; otherwise ask Q. 15b.

Q. 16. to Q. 17. Stress the underlined words since we want to make a distinction between those involved and those actually responsible. Read each item (a-d), waiting to get a "Yes" or "No" response for each.

Q. 18. Read each item (a-e) and then read the answer choices (except the "Don't know" category) for each item. You should get a response for each item.

Q. 19. Read the answer choices.

Q. 20. Read each item (a-b) and the answer choices, (except Don't know") getting a response for each.

Q. 21. Read each item (a-c) and the answer choices (except Don't know"), getting a response for each item. Be sure to stress the underlined words; in Q. 21a. you want to know what their feelings are, while in Q. 21b. you want to know what their feelings were.

Q.22a. Read the answer choices. The percentages are for the interviewer's use if R responds in those terms. If "All" skip to Q. 24.

Q.22b. Same as Q. 22a, except there is no skip pattern.

Note: Q. 23 has been deleted. Proceed to Q. 24.

Q. 24 and Q. 25 are set up as large tables. These tables are concerned with various arguments for and against the Bailly Nuclear Power Plant. The various arguments or issues are listed across the top of the page; while the questions and answer choices are listed down the side of the page.

In these tables, when you see an underlined space "__________", it means to read the arguments or issues that are listed across the top of the page; as before, the dots "........." mean to read the answer choices which are located down the side of the page. The general procedure for using these tables is to start by reading the question that is on the side of the page; when you reach the underlined space "__________", go to the top of the page and read an argument or issue; then go back to the side of the page to finish reading the question and/or to read the answer choices.

Q.24a. Read the question, but not the arguments. Circle the "1" for each argument or issue that the R mentions. If R mentions any other argument not already appearing on the table, specify this under "Other".

Q.24b. Ask Q. 24b. only for those arguments that R has not mentioned in Q. 24a.

Q.24c. to Q.24f. These questions should be asked only for those issues or arguments that R has mentioned in Q. 24a. and those which he/she answered "Yes" to in Q. 24b. Ask Q. 24c-f going down for each issue or argument; that is, you should ask all questions for each argument before you ask any questions about the next issue or argument.

Q.25a-f. Q. 25 follows the same format as Q. 24.

Q.24f. Only one answer choice is wanted. Probe sufficiently for one main source. If R says all equally, circle code "6". If uncertain, circle code "8". If R mentions more than one, but not all, circle all that are mentioned only after you have probed sufficiently.

Q. 26. Do not read the answer choices.

Q. 27. Read the answer choices.

Q. 28. Do not read the answer choices.

Q. 29. Do not read the answer choices. If R gives a general answer such as "high school", probe for the specific grade in high school.

Q. 30. Read the answer choices. Circle the level at which you get a "no" answer

Q. 31. Read the answer choices. If "Republican" skip to Q. 32a.; if

"Democrat", skip to Q. 32b.; if
"Independent", skip to Q. 32c.

Q. 32. Do not read the answer choices.

Don't forget to thank R at the end of the interview.

Also mark down the time the interview ended.

APPENDIX L.

SAMPLE OF AN INTERVIEW RECORD SHEET AND INSTRUCTIONS FOR USE

Citizen Opinion Surveys

Study and Respondent Identifiers

In this study there is one main study number: -----------690

In this study there are three "case studies":
    Drinking Water --------------------------------------6901
    Herbicide ---6903
    Bailly (Power Plant) --------------------------------6905

The Drinking Water Case Study has three citizen samples:
    West Lafayette, Indiana ---------------------------6901-3
    Lafayette, Indiana --------------------------------6901-5
    Indianapolis, Indiana -----------------------------6901-7

The Herbicide Case Study has two citizen samples:
    Close to the site (Touile) ------------------------6903-3
    Farther from the site (Salt Lake City) ------------6903-5

The Bailly Power Plant Study has two citizen samples:
    Close to the site (Chesterton-Dunes) --------------6905-3
    Farther from the site (Mich City, Gary, Valpo) -----6905-5

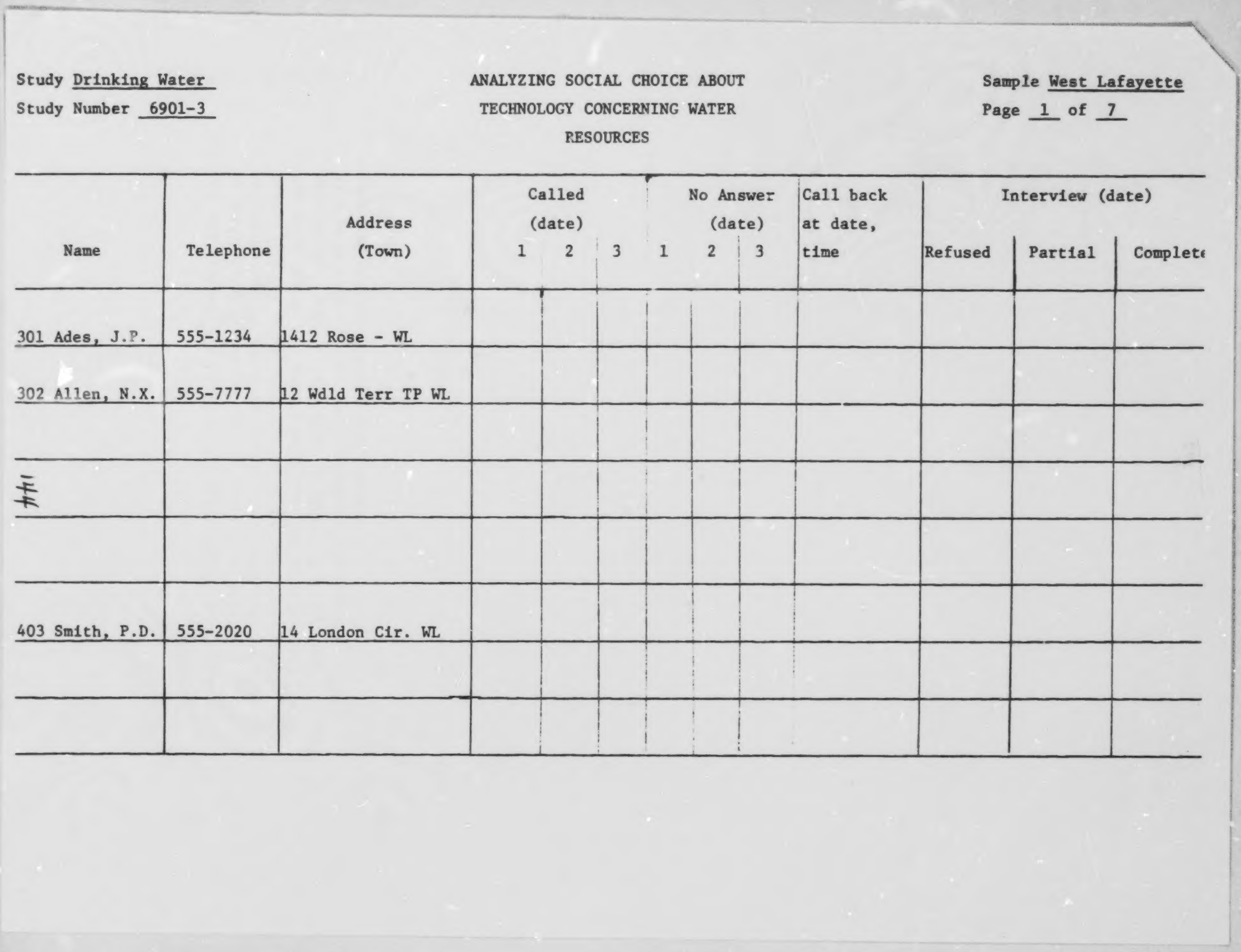
Each respondent (R), that is, each person to be interviewed, has a separate identification number, that also indicated what sample that respondent is in.

The number for the first person called, (say J. P. Ades), in the West Lafayette Sample of the Drinking Water Case Study is 301, or more completely, 6901-3-301. The second person, (say N. X. Allen), is 302, or more completely, 6901-3-302. The one-hundred-third person is the sample, (say P. D. Q. Smith) is 403, or more completely, 6901-3-403.

The seventy-seventh person in the Salt Lake Sample of the Herbicide Case Study (say X. X. Jones), is 6903-5-577. The one hundred twenty-third person in the same sample is 6903-5-623.

The first person in the Close Sample for the Bailly Case Study is 6905-3-301; the first person in the far sample is 6905-5-501 and so on.

YOU WILL FIND THE FIRST PART OF THE STUDY NUMBER (e.g. 6901 or 6905) at the top of the list of people to be called. THE SECOND PART OF THE STUDY NUMBER, WHICH IDENTIFIED THE SAMPLE (e.g. -3 or -5) will also be at the top of the page. THE THIRD PART OF THE STUDY NUMBER (e.g. 302 or 727) IS ALSO THE RESPONDENT'S IDENTIFICATION NUMBER, and is at the left of each name on the list. PLEASE PUT THE COMPLETE NUMBER ON EACH PAGE OF EACH QUESTIONNIARE.



Study Drinking Water
Study Number 6901-3

ANALYZING SOCIAL CHOICE ABOUT
TECHNOLOGY CONCERNING WATER
RESOURCES

Sample West Lafayette
Page 1 of 7

Name	Telephone	Address (Town)	Called (date)			No Answer (date)			Call back at date, time	Interview (date)		
			1	2	3	1	2	3		Refused	Partial	Complet
301 Ades, J.P.	555-1234	1412 Rose - WL										
302 Allen, N.X.	555-7777	12 Wdld Terr TP WL										
403 Smith, P.D.	555-2020	14 London Cir. WL										

APPENDIX M.

CASE STUDY ON DRINKING WATER

Decision Processes and Public Values in the Implementation of the Safe Drinking Water Act of 1974 in Indiana

by Jean Larvo and Heather Johnston Nicholson

Section 1 Introduction

This paper will report the analyses, conclusions, and recommendations of the Institute of Technology and Public Policy of Purdue University and the Institute for Water Resources Research concerning decision making and social choice in a low risk-high consequence technological situation, specifically safe drinking water in Indiana. Throughout the research, emphasis was on development of a comprehensive and systematic approach to the analysis of collective social choice with regard to policy decisions on water resources and technology. A review of the relevant literature on social evaluation of technological risk aided in determining the optimal techniques to apply. These quantitative techniques were utilized in the case study. The following sections describe the methodology (Section 2), findings and interpretations (Section 3), and conclusions and recommendations (Section 4) of the researchers.

Public decisions of a technological nature are often made in two areas. First, broad policies are outlined by elected or appointed decision makers; and, second, policies are implemented by agencies which specify them. In the case of safe drinking water the Congress passed the Safe Drinking water Act of 1974 (Public Law 93-523) requiring the Environmental Protection Agency (EPA) to promulgate standards that EPA would administer. This report focuses upon the process of decisions and the role of citizens.

Drinking water. Since the 1930's most Americans have assumed that public drinking water was free of microbiological and other harmful contaminants. In view of recent findings, however, the assumption that public water supplies in the United States are safe is subject to question. Investigations have found that while typhoid and cholera are nearly eliminated as problems in drinking water, organic contaminants and viruses have been discovered as harmful substances contained in water supplies (EPA, 1977). Also of concern are recent findings that drinking water contains substances which are believed to be potentially carcinogenic or otherwise toxic, such as various organic chemicals, certain heavy metals, radionuclides, and asbestos (EPA, 1975a).

Historical Summary. A brief history of the safety of public water supplies is appended to a report prepared by the Safe Drinking Water Committee of the National Academy of Science (NAS) and submitted to the Environmental Protection Agency (NAS, 1977). The discussion which follows depends heavily on that source. A more detailed history is presented by Murphy (1961).

The first clear proof that public water supplies could be a source of infection for humans was demonstrated by Dr. John Snow in 1854. In two studies, the Broad street pump study and the Lambeth Company study, he documented the transference of cholera by means of the water supply.

Later, in 1892, Koch gave evidence that filtration was an effective technique in improving the safety of the water supply. In his Hamburg and Altona studies in Germany, Koch found that Altona, even with an inferior water source, had a markedly lower incidence of cholera than Hamburg. The difference, he found, was due to filtration of the inferior source. He concluded that the role of filtration was to remove the contaminating bacteria from the water.

Water filtration experiments were carried out in the United States during the late 1880's and early 1890's by the Massachusetts State Board of Health. One important technological advance was the use of a chemical/coagulation filtration process that was patented about 1884. The Lawrence Massachusetts experiments proved that filtration was a key to the control of typhoid fever.

Filtration experiments at Louisville, Kentucky were important in demonstrating that successful treatment could be carried out on source waters that were of poor quality, in this case the polluted Ohio River. As a result of the Louisville study, engineering problems were deemed to be minimized by using mechanical filters and sand filtration and were put into use in 46 large cities.

Hazen writing at that time pointed out that filtration led to elimination of turbidity and color from the water and to a removal of about 99 percent of the bacteria present. These conditions were considered to be the standard by which the quality of treated water should be judged. The standards were adopted because they represented a purification that was reasonably satisfactory and that was at a cost which was not too burdensome. Information available at that time said that there was no evidence that the remaining germs were injurious although it was difficult to determine hazard with the technology of the time.

Chlorination, the most significant advance in water treatment, was introduced into the Jersey City, New Jersey water supply in 1908. This was due to complaints by the city to the private company supplying the city's water. Rather than incur the expense of a filtration plant, the company chlorinated the water. The results were dramatic; there was a marked drop in total bacterial count at a far lower cost.

The advantage of chlorination was its low cost which made it possible for any public waterworks plant to chlorinate where it proved to be advantageous. The use of chlorination grew rapidly until at present the greater part of the water supplied in the United States is treated in this way.

The introduction of chlorination also changed markedly the established ideas about water quality standards. The feeling of technicians at that time was that chlorination made it possible to hold contamination within one-tenth of one percent. Formerly, the level was felt to be corrected up to 1 percent. Technicians looked forward to a future time when the safety level could be raised even further. Optimistically, they felt when further developments were necessary they could supply the technology. At the time of chlorination introduction, technology had been developed so that studies of safety were not tied only to records of typhoid fever outbreaks. Evaluation could also be based on bacterial or coliform counts.

The basic concepts of providing safe drinking water were in evidence before World War I. Since that time there have been refinements in the technology that provides safe drinking water, but the prime motivation has been the same--to protect the public health especially against the spread of typhoid fever. Auxiliary consideration has been for aesthetics, appearance, taste, and odor.

The 1925 Federal Standards treat the concepts of risk and benefit that are central to this study.

The first step toward the establishment of standards which will insure the safety of water supplies conforming to them is to agree upon some criterion of safety. This is necessary because "safety" in water supplies, as they are actually produced, is relative and quantitative, not absolute. Thus, to state that a water supply is "safe" does not necessarily signify that absolutely no risk is ever incurred in drinking it. What is usually meant, and all that can be asserted from any evidence at hand, is that the danger, if any, is so small that it cannot be discovered by available means of observation. Nevertheless, while it is impossible to demonstrate the absolute safety of a water supply, it is well established that the water supplies of many of our large cities are safe in the sense stated above, since the large population using them continuously have, in recent years, suffered only a minimal incidence of typhoid fever and other potentially waterborne infections. Whether or not these water supplies have had any part whatsoever in the conveyance of such infections during the period referred to is a question that cannot be answered with full certainty; but the total incidence of the diseases has been so low that even though the water supplies be charged with responsibility for the maximum share which may reasonably be suggested, the risk of infection through them is still very small compared to the ordinary hazards of everyday life.

The problem with the preceding statement is that the incidence of typhoid fever can no longer be the determinant of the safety. This idea was also fallacious at that time. The Mills-Reincke theory stated that for every death from waterborne typhoid, there were several deaths from other diseases for which the causal agents were transmitted by water. There are data to substantiate their claim. Further, what is seen in the 1925 Standards is a reaffirmation of the uncertainty that technicians felt throughout drinking water history. They are dependent on technological development to assess the risk of drinking the water. Their best measure has been the outbreak of infection that can be tied to drinking water. This departs from the more sophisticated need for assessing the long term consequences of drinking unsafe water. Only recently has that technology begun to develop.

However, the public, lacking a technical laboratory and training, continue to assess the quality of their water by its appearance, taste, odor, and the incidence of disease attributed to it. (Analyses will clearly demonstrate this point in the third section of this paper). For most citizens, their drinking water is not an important issue. They perceive drinking water as having low risk and high benefits.

Federal Legislation Pertaining to Drinking Water. The main thrust of federal legislation has been to address the problem of control of communicable disease that is water borne. Until the passage of the Safe Drinking Water Act of 1974 the federal government was authorized to prescribe drinking water standards only for water supplies used by interstate carriers, and they were enforceable only with respect to contaminants capable of causing communicable diseases. The regulations were administered by the Public Health Service. These regulations covered perhaps 80 percent of all public water supplies in the U. S., but the focus was on disease control.

From the previous discussion of citizen perceptions about water, it is clear that impetus for stricter and more encompassing standards did not come from citizens. The evolution of federal regulation of drinking water is important in our discussion of social choice where risk, cost, and benefit must be juggled in the same equations.

The drive to set national standards for safe drinking water began in 1972 when the Senate passed a tough bill but the House did not respond with similar legislation. Again the Senate passed a bill on June 22, 1973, and again the House delayed action. Finally, the House passed the bill and President Ford reluctantly signed it in December, 1974. The reluctance was over the scope of the Environmental Protection Agency's powers. The opposition feared that EPA would gain too much authority from the Safe Drinking Water Act (SDWA). The administration contended that enforcement should be left entirely to the states, and court actions should be initiated by citizens (Congressional Quarterly, December 14, 1974.)

There were several factors that led to the passage of the SDWA. First, the impetus for more rigorous standards came from within the Public Health Service. There were those persons within PHS that felt there was a real need for control of public water supplies. At this time, water pollution was getting the most attention. This provided some cleanup of surface water sources, but sources of supply that used ground water were ignored.

Second, in 1969 a study was done by The Department of Health, Education, and Welfare. Within each region, one metropolitan area was chosen as a study area. The following quotation is from the New Orleans, Louisiana Community Water Supply Study (EPA, 1975b.)

> The purpose of the Community Water Supply Study (CWSS) was to determine if the American consumer's drinking water met the Drinking Water Standards (1962 U. S. Public Health Service Drinking Water Standards.) To obtain nationwide coverage, the Bureau of Water Hygiene of the U. S. Public Health Service initiated the CWSS in February of 1969 in nine areas across the country. The field work for the CWSS was conducted by the Bureau of Water Hygiene, in cooperation with the state and local health departments and the water utilities.
>
> "This study was designed to give an assessment of drinking water quality, water supply systems, and surveillance programs in urban and suburban areas in each of the nine regions of the Department of Health, Education, and Welfare. These areas were elected to give examples of the several types of water supplies in the country. A whole Standard Metropolitan Statistical Area (SMSA) was the basis of each study, except in Region 1 where the entire State of Vermont was included, with evaluations made on all public water supply systems, as defined herein, in each study area. This coverage allowed an assessment of the drinking water quality of the large central city, the suburbs, and the smaller communities located in the counties in the SMSA, and the interaction between them.
>
> The authority for the Community Water Supply Study is found in Title III, Part A, Section 301, Public Health Service Act, amended (42 U. S.C. 241).

The major findings of the CWSS were published in 1971 by the Public Health Service (EPA, 1975b). Generally, the findings of CWSS were that inadequate physical facilities, drinking water quality defects, and poor surveillance activities were found in both large and small cities regardless of geographical location. However, the larger systems were delivering an average quality drinking water consistent with the 1962 Drinking Water Standards. On the other hand 41 percent of the 969 systems studied were delivering water of inferior quality to 2.5 million people. This was prevalently systems servicing populations of less than 100,000 persons. Samples were found to contain fecal bacteria, lead, copper, iron, manganese, and nitrate in quantities that exceeded the Standards.

The major findings from the study are outlined below:

(1) Thirty-six percent of the 2,600 individual tap water samples contained one or more bacteriological or chemical constituents exceeding the limits of the DWS. Of these 9 percent contained bacterial contamination, 30 percent exceeded chemical limits, and 11 percent using surface waters as source exceeded the organic chemical limit.

(2) Fifty-six percent of the systems had deficiencies in their physical facilities such as poorly protected groundwater sources, inadequate disinfection capacity, inadequate clarification capacity, and/or inadequate system pressure.

(3) Seventy-seven percent of the plant operators were inadequately trained in water microbiology, and forty-six percent were deficient in chemistry relating to their plant operation.

(4) The majority of systems were unprotected by community control programs involving surveillance and inspection.

(5) Seventy-nine percent of the systems were not inspected by state or county authorities in the year previous to the study. In 50 percent of those cases officials did not remember when, if ever, a state or local health department had inspected; and 85 percent of the systems evidenced an insufficient number of bacteriological samples (69 percent did not even analyze half of the numbers required by DWS) EPA, 1975).

The significance of the findings, as pointed out by PHS and EPA, were that the technology now existed for the detection and destruction of most hazardous substances in water. The lack of attention and inadequate attention given to safe drinking water was a problem of broad, national concern. The water supply systems had been developed when raw water was of high quality. Such facilities were rapidly becoming obsolete. Not only were surface waters becoming more polluted with chemical contaminants but ground water, once thought to be safe to drink if palatable, was becoming suspect. During the survey, nine percent of the ground wells sampled showed coliform bacterial contamination.

The recommendations that came from the study called for modern facilities with qualified personnel under adequate surveillance to afford the lowest possible risk that current technology could offer. Secondary aesthetic recommendations were also made.

The report pointed up the current gap in rigorous standards. The 1972 Public Health Service Standards which applied to systems supplying interstate carriers, but were used by states as guidelines, were inadequate in regard to treatment of chemical contaminants. It pointed out the necessity for research in that area.

Third, the creation of EPA in 1970 gave hope to those within PHS that standards would be forthcoming. The major proposals of EPA were to change the inorganic chemical regulations and add organic chemical standards. Lawyers working for EPA stated that it would be impossible to amend the current standards, so a push began to get new encompassing regulations passed by Congress. Some of these were people who had been within PHS before the creation of EPA.

Fourth, again the need for national standards was displayed in a 1973 report from the General Accounting Office (GAO). In that report only 60 of the 446 water systems studied met federal standards for bacteria content and testing schedules. EPA estimated that the water received by millions of Americans did not meet the existing standards for safety. And those standards pertained only to control of waterborne communicable diseases. Both EPA and HEW were quick to point out that existing law did not allow regulation of contaminants which could cause chemical poisoning or other diseases. (Congressional Quarterly, July 20, 1974.)

Fifth, on November 7, 1974 the Environmental Defense Fund, the public interest group most vocal on the safe drinking water issue, released a study that claimed there was a significant relationship between cancer deaths and drinking water from the lower Mississippi River near New Orleans. The drinking water was purported to contain chemical contaminants which might cause cancer alone or in combination with chlorine used to purify the water.

Sixth, the next day EPA released its survey of New Orleans drinking water. The study listed 66 chemicals contained in the water. Some were suspected of being carcinogenic. Also the EPA launched an immediate study to determine the extent of the problem nationally.

On November 19, 1974 the Safe Drinking Water Act was passed by the House of Representatives and sent to the President. Ford threatened to veto the bill on three grounds, (1) he felt the EPA would hvve too much power over state governments, (2) federal grant assistance would be required, and (3) the act imposed federal regulation over underground drinking water sources. However, Ford reluctantly signed the bill.

Safe Drinking Water Act of 1974. The provisions of the Safe Drinking Water Act are:

(1) EPA was required within 180 days of enactment to issue interim primary standards for public drinking water supplies that would take effect within 18 months of their issuance.

(2) EPA was required to contract with the National Academy of Schinces for recommendation of maximum contaminant levels. The report was to be completed within two years.

(3) EPA was required to issue maximum contaminant levels allowable within 100 days of the NAS report to Congress. Further, EPA must issue required specific treatment techniques effective 27 months and 10 days from enactment.

(4) EPA must establish secondary standards for taste, appearance, and odor.

(4) Enforcement authority principally resides with the states that have adopted EPA primary standards, if they so desire.

(6) EPA was required to notify states of violations of primary standards and bring civil suits to force correction of violations if (1) the state did not correct within 60 days and failed to file a report, (2) or if the report was filed the state abused its discretion in carrying out primary enforcement, or (3) the state had not adopted primacy.

(7) Water supply operators were required to notify their users of violations of EPA regulations.

(8) Variances and exemptions were to be granted for compelling factors.

(9) EPA was required to establish regulations for programs protecting underground water sources.

(10) EPA has emergency authority to deal with water emergencies, including authority to allocate treatment chemicals including chlorine.

(11) Funds were allocated for research and training programs, special projects and demonstrations, and survey of rural drinking water.

(12) EPA was given authority to guarantee private loans of $50,000 to small public water systems.

(13) EPA was ordered to conduct a survey of carcinogens in drinking water.

(14) EPA was subject to judicial review of variances, action against violation, and alleged failure to carry out required duties prescribed by the SDWA.

As passed the Act includes the treatment of major issues that proponents of safe drinking water had been working for since 1968. Provisions are included for non-communicable as well as communicable diseases; regulations limit allowable chemical contaminants as well as non-chemical contaminants. The interim standards have become effective June, 1977, predominantly using the 1962 PHS standards as guidelines. The NAS report was delivered in June, 1977. Secondary standards have been drafted. All but two of the states have adopted primary enforcement responsibility for the SDW standards. (Pennsylvania and Indiana have not.) Guidelines have also been established for granting variances and exemptions. The Underground Injection Control (UIC) guidelines are drafted. NAS has also finished its report on cancer-causing substances in drinking water. Citizens will be notified when their drinking water contaminant levels go above the regulations. Ground water sources as well as surface water supplies are subject to regulation. Given the level of technological development, the risks that have been caused by recent, prolific chemical contamination may be reduced in drinking water.

Section 2 Methods: A Quantitative Situational Analysis (QSA)

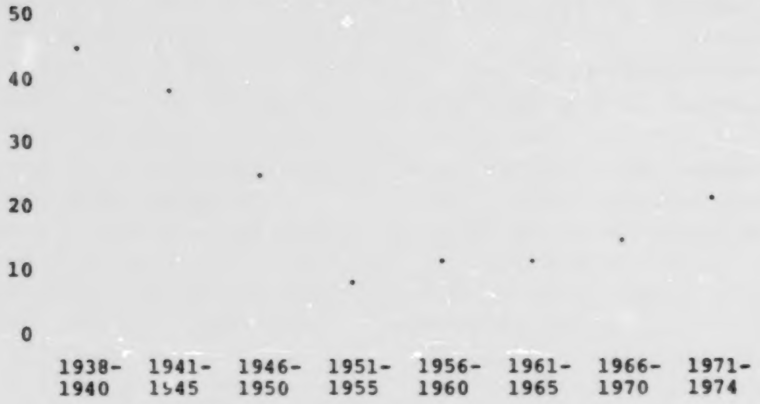
When each citizen drinks between one and five quarts of water a day, he usually assumes the water is safe. But the studies cited in Section 1 show that this may be an erroneous assumption. Actually a minimum of 4,000 known cases of waterborne illnesses occur each year in the United States, and the total number of cases is estimated at ten times that number. Further, the technology is only now developing that will discover what the effects of long-term, low-level exposure to contaminated water may be on humans.

In the period of 1961-1973, more than 200 outbreaks of disease or poisoning caused by contaminated drinking water were reported to the Center for Disease Control in Atlanta, Georgia. Twenty-two people died and 54,537 became ill. Many other cases were not reported because of failure to associate illnesses with contaminated drinking water (EPA, 1975c.)

In a report presented at the American Water Works Association (AWWA) Conference, analysis of outbreaks associated with drinking water during the period of 1971 to 1974 show 99 outbreaks resulting in approximately 17,000 cases of illness (Craun, et. al., 1976.) The two largest outbreaks occured in Rome, New York with 4800 cases of giardiasis in 1974 and Pico Rivera, California with 3500 cases of gastroenteritis in 1971. To put this information in an historical perspective, observe the graph below which shows the average annual number of waterborne disease outbreaks between 1938 and 1974.

Table 2.1

Average Annual Number of
Waterborne Disease Outbreaks
1938-1974



Source: Craun, et. al., 1976.

From the graph we see a leveling off of the average number of outbreaks in each year beginning in 1951 until a rise began again in 1971. This seems to parallel the contention made by EPA and PHS that, although chlorination seems to have harmful bacteria under control, there is an increasing danger from chemical contaminants. However, there is not causal linkage demonstrated by this table.

In light of the information linking drinking water to ourbreaks of disease, do citizens and decision makers perceive there is risk involved? Do the benefits from drinking water outweigh the risks at some cost level? What tradeoffs are made in the public arena? The purpose of this study has been to assess the risk/benefit perceptions of decision makers and citizens concerning safe drinking water and the choices that are made in the public arena. The specific objectives of the analysis were:

To determine citizens' perceptions of:

- the source of their water supply and procedures for testing it
- the first order and second order characteristscs of their drinking water
- desirable or undesirable substances in drinking water
- who is responsible for handling problems with drinking water when they do occur
- who should/does have decision making authority for drinking water
- the extent to which decision makers consider citizen preferences
- the level of their own and other citizens' political and social activity

To determine decision makers' perceptions of:

- how citizens perceive their water service
- responsibility regarding the role of the public in decisions of social choice
- relation of groups involved in decision making about drinking water standards
- ease of implementation of the Safe drinking Water Act
- likelihood of dangerous contamination

of drinking water

-substances that are likely to cause serious illness if they occur in drinking water

-factors that are important to consider for the testing schedule

To accomplish this task quantitative situational analysis was performed. Two data sets were collected--a random sample of affected citizens and a purposive sample of direct participants. The data sets are described below.

Purposive sample of direct participants. Since drinking water standards are administered at several governmental levels with both public and private interest groups and citizens participating, it was necessary to carry on the research at many levels. These included:

1. National (Federal)
2. Regional
3. State
4. Water company
5. Interest groups

The federal government, with the ultimate responsibility for safe drinking water, administers the SDWA through the EPA's Water and Hazardous Materials Division (Figure 2.1).

A statement from EPA outlines its functions:

> EPA's water quality activities represent a coordinated effort to restore the Nation's waters. The functions of this program include *development of national programs, technical policies, and regulations for water pollution control and water supply*; water quality standards and effluent guidelines development; technical direction, support, and evaluation of regional water activities; development of programs for technical assistance and technology transfer; and provision of training in the field of water quality (EPA, 1976) (emphasis added).

EPA research for water is carried out in the Municipal Environmental Research Laboratory in Cincinnati, Ohio (Fig. 2.1). The national programs are administered to the states through the regional offices of EPA. The focus of this report is upon Region 5 because the citizen samples were drawn from that Region. The regional office is in Chicago, Illinois.

Again, a statement from EPA outlines the functions of the regional offices:

> The mission of the Water Supply Branch is to assure an adequate supply of safe drinking water for all people in Region 5. The *Office of the Branch Chief* directs the EPA Region 5 water supply program within the broad guidelines and policy established by EPA headquarters and the Director of the Region 5 Water Division. It serves as the regional focal point for all matters relating to the safety of drinking water, the reliability of water supply systems, ground water protection, and implementation of the Safe Drinking Water Act. *The State Programs Section* acts as the interface between EPA and the Region 5 states concerning P.L. 93-523 primary enforcement responsibility and program grants. It develops and evaluates state drinking water supervision programs. It reviews the adequacy of state programs to qualify for primary enforcement responsibility. It provides advice on planning, developing, and coordinating state program activities and developing staffing and budget needs. It helps develop and evaluate state water supply legislation, regulation, and policy. It reviews and processes annual state plans and grant requests and conducts continuing review of state programs. It provides technical assistance to develop improved state programs. It directs EPA primacy programs where required. The *Water Supply Systems Section* provides technical assistance to aid public water supply systems to meet the requirements of the primary drinking water regulations. It responds to specific requests for assistance prior to the initiation of an enforcement action. It provides regional expertise on toxic substances in drinking water and solutions to related problems. It prepares information on contaminants in drinking water--how to identify and quantify them, their health effects, appropriate water treatment technology, and costs. It participates

> in workshops, seminars, conferences, etc., to promote good water treatment practices. It coordinates the collection, processing, maintenance, and evaluation of data required by drinking water regulations. The Underground Injection Section develops and evaluates state drinking water supervision programs. It reviews the adequacy of state programs to qualify for primary enforcement responsibility. It provides regional expertise on protection of underground sources of drinking water. (EPA, 1976).

The Region 5 EPA is administering the Safe Drinking Water Act, since Indiana has not elected to assume primacy. According to one informant, Indiana chose not to assume primacy because of differences with EPA administrators on previous policies. However, regional administrators deal directly with state officials at the Indiana State Board of Health which is located in Indianapolis, Indiana. There two divisions deal with quality of drinking water. (Figure 2.2).

Previous to the Interim Standards of the SDWA, the Indiana State Board of Health through its water supply section administered standards that were similar to the 1962 PHS standards. The Bureau of Laboratories was also involved in water quality through testing and research (ISBH, 1976).

Directly involved in the supply of safe drinking water are the water companies throughout the state. The sample was chosen, as was the citizen sample, from three cities in Indiana--Indianapolis, Lafayette, and West Lafayette. These cities allowed a variety of organizational systems to be studied. The Indianapolis Water Company is a private, investor-owned company that uses surface water as its source of supply. The Lafayette Water Company is a municipally owned water company that uses ground water as its source of supply. The West Lafayette Water Company is privately owned by a company with other branches in Pennsylvania and Indiana. Its source of supply is ground water. (Figure 2.2). Comparisons among the water service are made in the following section.

Interest groups are other institutions which are involved in the decisions about water quality. (Figure 2.3) Through interviews and perusal of legislative testimony, the following groups were found to be active in drinking water decisions at the federal level:

Public Interest Groups---

League of Women Voters of the United States
Center for the Study of Responsive Law
National Resources Defense Council
National Wildlife Foundation
Cornell Water Resource Center
Environmental Defense Fund
Izzak Walton League

Professional Interest Groups---

National Water Well Association
American Water Works Association
American Medical Association
Conference of State Sanitary Engineers
American Academy of Environmental Engineers
National Water Supply Improvement Association

Within the state of Indiana these groups were reported as being active:

Public Interest Groups---

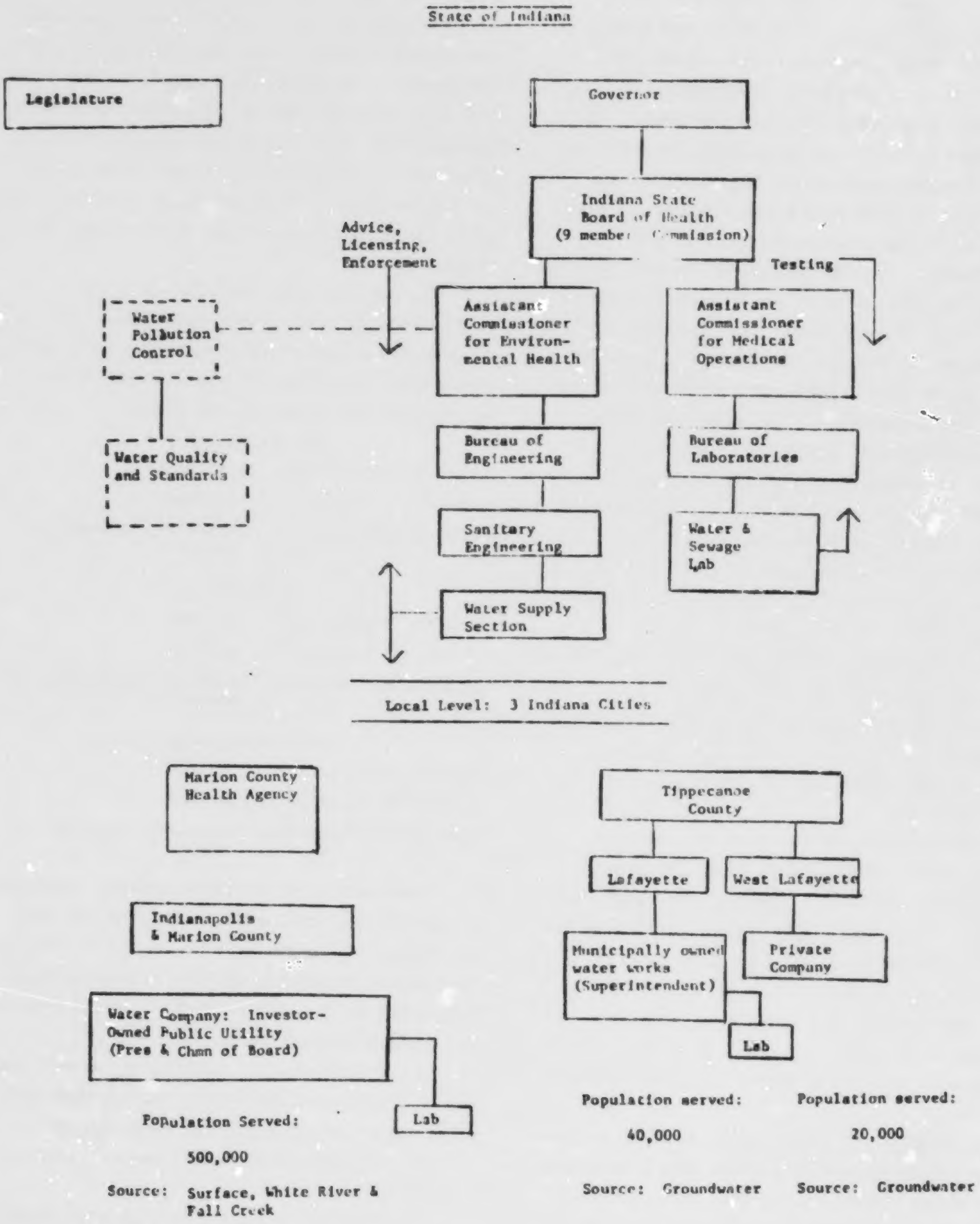
Hoosier Heartland
Citizens Energy Coalition
Indiana Public Interest Research Group

Professional Interest Group---

Indiana Society of Professional Engineers
Great Lakes Upper Mississippi River Board
  of State Sanitary Engineers

To ascertain information at all these levels of decision making, a survey instrument was prepared. Twenty-four interviews were conducted using this schedule. Of those, five were with public and professional interest groups that were present at the hearing of the Safe Drinking Water Act before the Subcommittee on Environment of the Committee on Commerce of the Senate on May 31, 1973. Seven were with EPA officials in Washington, D.C. One response was from an EPA Region 5 official. Four interviews were conducted with the Indiana State Board of Health. Two interviews were

Figure 2.2
ORGANIZATIONAL CHART FOR QSA ON SAFE DRINKING WATER: GOVERNMENTAL AGENCIES AND WATER SUPPLIERS STATE AND LOCAL LEVELS


State of Indiana
Legislature
Governor
Indiana State Board of Health (9 member Commission)
Advice, Licensing, Enforcement
Testing
Water Pollution Control
Water Quality and Standards
Assistant Commissioner for Environmental Health
Assistant Commissioner for Medical Operations
Bureau of Engineering
Bureau of Laboratories
Sanitary Engineering
Water & Sewage Lab
Water Supply Section
Local Level: 3 Indiana Cities
Marion County Health Agency
Indianapolis & Marion County
Water Company: Investor-Owned Public Utility (Pres & Chmn of Board)
Lab
Population Served: 500,000
Source: Surface, White River & Fall Creek
Tippecanoe County
Lafayette
West Lafayette
Municipally owned water works (Superintendent)
Private Company
Lab
Population served: 40,000
Population served: 20,000
Source: Groundwater
Source: Groundwater

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conducted with the Indianapolis Water Company, three from the Lafayette Water Company, and two from the West Lafayette Water Company. Persons were chosen so that a variety of those involved with drinking water would be represented. At the federal level not only EPA administrators but also members of the Government Accounting Office staff performing an assessment of implementation costs were interviewed. At the state and local levels administrators as well as laboratory personnel were interviewed. In the analyses in Section 3, the 24 persons interviewed in the purposive sample are referred to as direct participants. The topics within the questionnaire were:

1. Information on position relating to water supply and length of involvement
2. Perceptions of the relationship of organizations interested in water quality
3. Perceptions of the role of organizations toward social choice
4. Information regarding the implementation of the Safe Drinking Water Act
5. Factors important in drinking water standards
6. Likelihood of contamination of drinking water

The questionnaire evolved in two forms. One schedule was used for personal interviews, and one schedule was used for mailing. The interviews were converted to machine readable form, and transcripts of the personal interviews were retained for their additional information. Analyses of these are included in Section 3. Their comparisons are also made with the citizen samples.

Random samples of citizens. From a review of the literature describing the evolution of drinking watrr standards, it appeared that impetus for standards came from within the federal and state governments and from interest groups active at the national level. This study of social choice, sought to determine what role citizens play in standards for their drinking water. What do citizens think of their water service? Are there citizens who are likely to get involved in developing standards for safe drinking water? Which citizens have made appeals for safe drinking water? To whom have these appeals been made? The purpose of collecting a data set from citizens was that these and other questions might be answered.

To achieve the maximum variety possible with the given resources, three case studies were implemented. Size of population, source of supply, and type of management vary among the three.

Indianapolis

Size of Population	500,000
Source of supply	surface
Type of management	private, investor owned

Lafayette

Size of Population	40,000
Source of supply	ground
Type of management	public, municipally owned

West Lafayette

Size of Population	20,000
Source of supply	ground
Type of management	private, company owned

Telephone interviews lasting between 15 and 30 minutes were conducted during the month of August, 1976, using a survey instrument prepared by the research team (Appendix E to main report). Topics within the questionnaire were:

1. Information relating to water supply
2. Information about the social and political activity of the respondent
3. Characteristics of social, economic, and political status
4. Perceptions of the quality, appearance, safety, and hardness of their water supply
5. Activities, either potential or

realized, concerning the quality of their drinking water

6. Preferred level of authority in water decisions

7. Perceptions of decision makers' awareness of citizens' preferences when decisions are made

Coding and computer analysis. The quantitative data sets were coded to numeric, machine-readable format. Wherever suitable, interval levels of measurement were preserved. Nominal variables (that is, discrete categories with no order implied-in this case the cities are an example) were assigned numeric values to facilitate analysis. As always, missing or uncodable responses were encountered. These seemed to fall into two categories. Among the direct participants some were reluctant to state their position, feeling they might not be representative of the group. For the citizen sample, nonresponses were most frequent when technical perceptions were asked for. In these cases, as much information as was available was coded. The result is that different numbers of cases are given for different variables, because cases were dropped from analysis when information for that variable was missing. No assumptions are made for nonrespondents.

Data were analyzed using a CDC, Model 650 at Purdue University, West Lafayette, Indiana. Analysis was accomplished using SPSS, Statistical Package for the Social Sciences, Version 6.5. This specifies subroutines FREQUENCIES, CROSSTABS, CONDESCRIPTIVE, and GUTTMAN SCALE with appropriate distributions and statistics. Tables in the next section are taken or compounded from the output of these subroutines. Statistics and procedures appropriate to nominal (discrete categories) and ordinal (rank) levels of measurement were used in most cases.

The purposive sample of direct participants contained four Likert scales in an attempt to assess the relative dangers in drinking water. These scales consisted of nine or ten items which the respondents were asked to rank in order of importance in testing water supplies. It was necessary to recode these responses so that 9 became the highest score and one or zero the lowest score. The results are reported in Section 3.

Statistics. Most information in this report will be given in percentage form. The percentage for each category as well as the number of cases (N) will be reported. Frequency distributions will describe the perceptions of the respondents in the two data sets. When bivariate analysis is used, output will be displayed with the independent variable at the top and the dependent variable at the side of the table. Then column percentages will be displayed so that comparison across the independent variable can be made.

The main independent variables varied for the two data sets. For the purposive sample, level of decision making and type of decision maker were the key independent variables; and for the citizen sample city, source of supply, social characteristics, and political preference were the main independent variables.

Two summary statistics are used in bivariate analysis. First, Chi-squared (X^2) is used to report statistical significance. That is, the findings of the analysis are checked against a given norm, as a basis for inferring that the relationship is a causal one, or that the relationship might have appeared by chance. The computing formula for X^2 is:

$$X^2=(f_o-f_e)/f_e$$

where f_o=observed frequencies

f_e=expected frequencies based on marginal distribution

In some cases findings in bivariate tables may not be statistically significant but may be substantively important. This will be pointed out in the discussion on the findings where this occurs.

Second, several statistics adjust chi-squared for sample size and/or table size so that a measure of the strength of association can be determined. Measures of association vary between 0.0 and 1.0 with zero indicating no relationship (statistical independence) and 1.0 indicating perfect association where values for the dependent variable change in a predictable pattern with the independent variable. Cramer's V and Tau C are two such measures of association used in this report. Their formulae are given below:

$$V = \sqrt{X^2 / mn}$$

where $m = (r-1)$ or $(c-1)$, whichever is smaller

n=number of cases

r=row

c=column

$$\text{Tau } C = \frac{S}{\frac{1}{2}N^2 \left[(m-1)/m\right]}$$

where $m = (r-1)$ or $(c-1)$, whichever is smaller

S=number of concordant pairs - number of discordant pairs

(Blalock, 1972)

The above measures allowed the researchers to test whether relationships exist within the data sets, and whether those relationships happened by chance or can be generalized. The next section presents the analyses of the data collected.

Section 3 Results and Interpretation

This section presents analysis of the data collected in the field. First, descriptive information will be given for the purposive sample of direct participants and the random citizen samples. Second, perceptions of both samples concerning safe drinking water will be reported and compared. Third, analysis of special topics pursued by members of the evaluation team on decision-making and safety will be presented.

Direct participants. The responses of the 24 direct participants interviewed are reported below. The adjusted frequency is reported for each table; that is, the missing data are excluded in calculations. The number of responses in each table ranges from 21 to 23 ($N \leq 24$). Rounding error produces totals of ±100 percent.

Ground water and surface water differ in several important ways when consideration is given to standards for drinking water. Surface water is a less stable source subject to contamination from pesticides, spills, weather conditions, and dumping. Perceptions of decision makers may differ because of the source of supply they are thinking of in responding. Table 3.1 shows the source of supply with which those who were interviewed were most familiar. Later this variable will be cross-tabulated with perceptions of water quality and safety.

Table 3.1

Direct Participants: Familiarity with Sources of Water Supply

Ground water	21.7%
Surface water	13.0
Ground and surface	56.5
Not ascertained	8.7

Data were also collected to describe the direct participants themselves. It was felt that length of involvement with drinking water policies could be an explanatory variable. Although the SDWA was passed only recently, some of those interviewed dealt with drinking water before that time, as Table 3.2 shows.

Table 3.2

Direct Participants: Length of Time in Present Organization

1-3 years	18.2%
4-6 years	4.5
7-9 years	4.5
10+ years	54.5
Not ascertained	18.2

Tables 3.3 and 3.4 describe the job presently held by the decision makers in terms of tenure and method of selection.

Table 3.3

Direct Participants: Length of Time in Present Position

less than 1 year	14.3%
1-3 years	42.9
4-6 years	4.8
7-9 years	14.3
more than 10 years	23.8

Table 3.4

Direct Participants: Method of Selection

elected	8.7%
appointed	17.4
civil service	56.5
private company	17.4

The SDWA allowed EPA to promulgate and enforce broad, national minimum standards for all regions of the United States. Not all agreed that centralization of policy was necessary. Perceptions could be influenced by the role one has in formulating, implementing, and enforcing safe drinking water standards. Tables 3.5 and 3.6 characterize the respondents according to their role in these processes.

Table 3.5

Direct Participants: Role in Making Standards

Yes, direct	21.7%
Yes, indirect	39.1
No	39.0

Table 3.6

Direct Participants: Role in Implementing and Enforcing Standards

Yes, direct	18.2%
Yes, indirect	45.5
No	31.8
Not ascertained	4.5

These respondents were asked about their perceptions of many phases of safe drinking water delivery--institutions, organizations, and citizen activities; risk/cost/benefit analysis; and social choice. These analyses are given under the subheadings below.

Direct Participants: Institution, Organization, and Citizen Activities.

Several questions concerned the institutions and groups which might be involved with water quality in Indiana and the United States. Table 3.7 gives the frequency of the number of decision makers mentioned who are involved in setting standards for water quality.

Table 3.7

Direct Participants: Number of Decision Makers Mentioned

one	33.3%
two	27.8
three	27.8
four	5.6
six +	5.6

Of those, by far the most frequently mentioned were EPA and the Indiana State Board of Health. However, also mentioned were the local Boards of Health (usually county administered), local water companies, local industries, the National Safe Drinking Water Council, and the American Water Works Association.

The preceeding question dealt exclusively with those institutions that were perceived to be specifically involved with setting standards. However, respondents were also asked to name all groups in the community or state which are active and interested in issues of water quality. The two most frequently mentioned groups were the Environmental Defense Fund (EDF), a public interest group, and the American Water Works Association (AWWA), a professional interest group. Also mentioned were local politicians (unspecified), Hoosier Heartland, Citizen Energy Coalition, Indiana regional planning districts, Indiana Public Interest Research Group, and the Sanitary Engineering and Water Divisions of the state of Indiana. Nationally, the American Medical Association, League of Women Voters of the United States, International Ozone Institute, Natural Resources Defense Council, National Wildlife Federation, Cornell Water Resource Center, Izzak Walton League, AWWA, Conference of State Sanitary Engineers, and the National Water Supply Improvement Association were perceived as being interested in water quality.

To refine the above list, respondents were asked to name the groups which have a direct bearing on water quality. They were local industries, local and state water supply operators, and state governments. Both public and professional interest groups were mentioned, but professional groups were mentioned two times more frequently than public groups.

What emerges from the analysis is that many groups both public and private at the local, state, and national levels are involved in discussions of safe drinking water; but not all groups are perceived to have an equal impact on standard setting. The frequency distributions show the major actors to be the EPA, the Environmental Defense Fund, and the American Water Works Association, as the respondents see it.

This influence of groups and institutions in the decision making process has long been noted. However, the relationship between groups and citizens has not been fully explored. This case study gives an opportunity for study in a technological situation. This distinction is made because some argue that specialized knowledge is necessary for interaction in decision making. The purposive sample was asked about its relationship with citizens. The following tables depict their responses.

Table 3.8

Direct Participants:
Responsibility for Giving Information to Citizens

Active role, whether solicited or not	58.8%
Passive role, response to questions	17.6
No responsibility	23.5

Table 3.9

Direct Participants:
Responsibility for Getting Views of Citizens

Active role	41.1%
Passive role	35.3
Minimal role	5.8
No responsibility	17.6

Table 3.10

Direct Participants:
Information Competence of Citizens

Citizens are informed	9.1%
Citizens minimally informed	40.9
Citizens uninformed	45.5
Not ascertained	4.5

Table 3.11

Direct Participants:
Attitude Toward Citizens

Active role; servant, helper	63.6%
Passive role; respondent to citizen demands	9.1
Citizen as mild constraint to effective functioning	13.6
Citizen as impeding functioning	13.6

These data suggest that the direct participants see themselves in an elite position taking an active role in decision making since the public is largely uninformed. From Table 3.9 it appears that fewer than 42 percent feel a responsibility to solicit citizen views. However, nearly 60 percent feel an obligation to give citizens information, although most felt citizens were not utilizing this information. Further study might reveal whether citizens would not or could not be informed.

Direct Participants and Social Choice. Some of the problems in ascertaining societal choice are pertinent. First, citizens do not have or express a policy preference on every issue. Second, political decisions are not bound by societal choice. Decisions are often incremental rather than fundamental. Third, legislators do not act disinterestedly. Fourth, increasingly decisions concerning technology are negotiated.

The survey asked for responses to several questions about the Safe Drinking Water Act and its feasibility and the larger issue of choice. Later these responses will be compared with citizen responses to a similar question.

All of those in the purposive sample were aware of the Safe Drinking Water Act, and 83 percent were familiar with the standards. At the time of the survey, interim standards had been promulgated by EPA; but the standards were not yet in effect. The following responses give an indication of how the standards were viewed in advance of their implementation.

Table 3.12

Direct Participants:
Feasibility of SDWA Implementation

Yes, immediately	31.6%
Yes, gradually or with qualification	57.9
No, not feasible	0.0
Respondent disclaims knowledge	5.3
Not ascertained	5.3

The feasibility variable was crosstabulated with the variable that classified the level of government in which the respondent operated. This was done to test whether perceptions of feasibility were shared among decision makers at the same level. Table 3.13 below gives the results of the crosstabulation. Although the analysis did not procure significant chi squared and Cramer's V, it is interesting to observe the distribution. Local respondents who knew the standards were evenly divided over the time period of implementation. Respondents at the state level who were asked about implementation all expressed reservation with concern to time. The results shown in Table 3.13 and Table 3.12 agree with the opinions expressed in the interviews--federal law will be implemented over time.

Table 3.13

Direct Participants:
Feasibility of Implementing SDWA, by
Level of Respondent

	L	S	R	F
Immediate	42.9%	0.0	100.0	28.6
Gradual	42.9	75.0	0.0	71.4
Respondent disclaims knowledge	14.3	0.0	0.0	0.0
Not ascertained	0.0	25.0	0.0	0.0

Note: L=local
S=state
R=regional
F=federal

Throughout the discussions preceding the safe drinking water legislation, the issue of safe water was clear-cut. It was agreed that providing safe drinking water was a desirable policy. However, a controversy centered on which level of government should administer the program. The purposive sample (as well as the citizen sample) was asked to define the role they would prefer each level of government to have in the delivery of safe drinking water.

Table 3.14

Direct Participants: Federal Involvement in Drinking Water

Primary, with enforcement responsibility	52.2%	(12)
Advisory, with no enforcement	17.4	(04)
No direct role, or very limited	26.1	(06)
Respondent disclaims knowledge	4.3	(01)

Table 3.15

Direct Participants: State Involvement in Drinking Water

Primary, with enforcement responsibility	59.1%	(13)
Advisory, with no enforcement	22.7	(05)
No direct role, or very limited	9.1	(02)
Respondent disclaims knowledge	4.5	(01)
Not ascertained	4.5	(01)

Table 3.16

Direct Participants: Local Involvement in Drinking Water

Primary, with enforcement responsibility	33.3%	(07)
Advisory, with no enforcement	38.1	(08)
No direct role, or very limited	14.3	(03)
Not ascertained	14.3	(03)

From the tables it appears that the respondents agree with the SDWA which provides for states as the primary directors of drinking water safety with federal enforcement if the states choose not to assume primacy. Local involvement is limited. When each of the above variables was crosstabulated with level of government of the respondent, no significant relationships appeared.

Direct Participants: Risk/Cost/Benefit Analysis. In technological situations assessments of risk are complex. Earliar portions of this report dealt with increasing awareness of the problems caused by possible contamination of water supplies. The purposive sample was asked to rate the likelihood of contamination of the drinking water supply in Indiana as a measure of risk.

Table 3.17

Direct Participants: Likelihood of Contamination in Indiana

Some likelihood	47.8%
Very slight chance	30.4
No chance	13.0
Respondent disclaims knowledge	8.7

When these responses were crosstabulated with the source of supply with which respondents were most familiar, a significant relationship appeared.

Table 3.18

Direct Participants: Likelihood of Contamination by Source of Supply

N=23	Ground	Surface	Both	Not ascertained
Some	25.5%	0.0	76.9	0.0
Very slight	25.0	66.7	23.1	50.0
None	25.0	33.3	0.0	50.0
Respondent disclaims knowledge	25.0	0.0	0.0	0.0

X^2=.06

T^b=.06 (sig.)

While the expectation that surface water would be seen as an unstable source of supply did not hold, it appears that those who deal with both ground and surface water are more skeptical of the safety of drinking water supplies. Likelihood of contamination was also crosstabulated with level of government of the direct participant. The results are shown in Table 3.19

Table 3.19

Direct Participants:
Likelihood of Contamination by
Level of Respondent

N=23

	Local	State	Federal
Some	16.7%	25.0%	66.7%
Very slight	33.3	75.0	16.7
None	16.7	0.0	16.7
Respondent disclaims knowledge	33.3	0.0	0.0

T^C= .01 (sig.)

This table shows that those at the local level are more reluctant to commit themselves to a position on the safety of drinking water, yet it is at this point that delivery occurs. At the federal level the decision makers are more concerned about safety.

The respondents were also asked to rate the public's perception of the likelihood of drinking water contamination in Indiana. The responses are in Table 3.20.

Table 3.20

Direct Participants:
Public Perception of Likelihood
of Contamination

Some likelihood	29.4%
Very slight chance	23.5
No chance	41.2
Respondent disclaims knowledge	5.9

In one interview with a local decision-maker the view was expressed that the public should not be concerned about the safety of its drinking water. Appropriate standards and enforcement procedures had been promulgated. At the federal level more concern was expressed that regulation does not necessarily have the intended outcome; and standards must continually be updated to encompass all aspects of our changing technological society.

The final section of the purposive survey dealt with the direct participants' own perceptions of risk in drinking water. They were asked to rank the factors that are important to consider in setting the testing schedule for water supplies, the substances that are important to test for, and the likelihood of serious illness or death to humans if the substance occurs at unacceptable levels in drinking water. The average rankings are given below. These were determined by ranking the mean score for each variable.

Table 3.21

Direct Participants

(A)

Factors that are Important in Determining the Testing Schedule for Drinking Water:
Responses in Average Rank Order

1. Size of the population of the community consuming the water
1. Long term consequences of not testing
3. Immediate consequences of not testing
4. Federal regulations and guidelines (presently)
5. Accuracy of available tests
6. Available resources, including technicians to carry out tests
7. Time required for analysis
8. Number of samples required for comprehensive testing
9. Cost of analysis

(B)

Substances that are Important to Test for:
Responses in Average Rank Order

1. Harmful bacteria
2. Harmful viruses
2. Heavy metals
2. Inorganic toxins
5. Pesticides
6. Radioactive substances
7. Odor-causing substances
8. Murkiness

(C)

Likelihood of Occurence at Unacceptable Levels: Responses in Average Rank Order

1. Odor-causing substances
2. Murkiness
3. Harmful bacteria
4. Heavy metals
5. Radioactive substances
6. Pesticides
7. Harmful viruses
8. Inorganic toxins

(D)

Likelihood of Death or Serious Illness in Humans if Substances Occur at Unacceptable Levels: Responses in Average Rank Order

1. Harmful bacteria
2. Harmful viruses
3. Inorganic toxins
4. Heavy metals
5. Pesticides
6. Radioactive substances
7. Murkiness
8. Odor-causing substances

The reader can note the consistency of response from one question to the next. The responses in Tables 3.21 A and D, on "importance in testing" and "the likelihood of death or serious illness" respectively, are in nearly complete agreement. Responses in Table 3.21 D also correspond to the earlier discussion of the risk of harmful bacteria in drinking water. Craun, McCabe, and Hughes (1976) pointed up the high incidence of disease attributable to bacteria in drinking water.

Citizen sample. In presenting the analysis of the citizen data set, the same format is followed as the format of the purposive data set. First, source of water supply will be presented; then characteristics of the citizen sample will be addressed. Finally, analyses of institutions, organizations, and citizen activities; social choice; and risk/cost/benefit analysis are given.

The distinctions between ground water and surface water have been made elsewhere in this report, as was the point that Indianapolis' source of drinking water is surface water and Lafayette's and West Lafayette's source is ground water. The citizen sample was asked to name the source of their water supply. As shown in Table 3.22, 52 percent of the citizens sampled disclaimed knowledge of the source of their water supply.

Table 3.22

Citizens: Respondents' Identification of the Source of Water Supply

	Percent	Number
Ground	30.0%	107
Surface	16.0	57
Other	1.7	6
Don't know	52.4	187

For those who did make a response, cross-tabulation was done by city to determine the percent that were correct.

Table 3.23

Citizens: Proportion Correctly Identifying Ground or Surface Supply

West Lafayette (Ground)	
Percent Correct	37.1%
Number in Sample	116

Lafayette (Ground)	
Percent Correct	40.3%
Number in Sample	119

Indianapolis (Surface)	
Percent Correct	25.4%
Number in Sample	121

Randomization of the sample groups controlled for a normal distribution of social, economic, political, and cultural characteristics. Other characteristics important to the discussion of social choice are the levels of political and social activity of the respondents. To predict whether or not citizens will take the active part anticipated by requiring notification of citizens when standards for drinking water are not being met, it is important to know the extent to which citizens are active in general.

Table 3.24

Frequency with which Respondent Discusses Local Politics

Never	16.3%
Seldom	34.1
Some of the time	42.3
Most of the time	7.0
All of the time	.3

Table 3.25

Citizens: Frequency with which Respondent Offers Own Opinion in Discussions of Local Politics

Never	2.6%
Seldom	20.9
Some of the time	38.1
Most of the time	23.5
All of the time	14.9

Table 3.26

Citizens: Number of Discussions of Local Politics per Week

One	15.4%
Two	15.8
Three	17.8
Four	15.8
Five or more	35.3

Table 3.27

Citizens: Frequency of Interaction with Friends

Never	4.0%
Less than once a month	6.0
Once a month	9.7
Twice a month	15.1
Once a week	25.4
Few times a week	22.7
Daily	17.1

From the random citizen sample we can see that 76.4 percent (seldom and some) of the respondents spend some time discussing local politics. This does not denote a high level of political activity, but possibly a discussion of issues that have reached the political arena. Further, 59 percent of the respondents sometimes offer their opinions. This does not seem to be a high level of activity until the responses to the question of the number of political discussions per week are examined. There, the largest percentage (over one-third) of respondents said they engaged in five or more discussions per week. This table gives some indication of the respondents' degree of political activity. Table 3.27 gives an indication of the social activity of the respondents. That is, 65.2 percent of the citizens say they interact with their freinds at least once a week.

This information allows for an understanding of what citizen reactions might occur if safe drinking water became an issue in the public arena. The federal regulations require public notification when standards are violated as a deterrent, and so that public pressure may be brought to bear to produce changes.

Pertinent to the point of notification requirements are the citizens' sources of information on local news.

Table 3.28

Citizens: Source of Most Local News

Radio	17.7%
TV	28.2
Newspaper	40.0
Friends	.8
Radio, TV	2.5
Radio, newspaper	2.0
TV, newspaper	8.2
Other, combinations	.6

The Safe Drinking Water Act requires notification when the maximum allowable standards are exceeded. The newspaper seems to be the most effective means of making citizens aware of local occurences, with 50.2 percent of the respondents citing the newspaper, either alone or in combination with another source, as their primary source of local news.

To link citizen activity to the safe drinking water issues, the citizens were asked their perceptions and opinions concerning the delivery of safe drinking water. The analysis of this data follows.

Citizens: Institution, Organization, and Citizen Activities. To determine the public's perception of what institutions are involved in setting standards for drinking water, several questions were asked of the citizen sample. First, respondents were asked whom they would contact about their drinking water should problems arise, Table 3.29.

Table 3.29

Citizens: Institution Contact if a Problem With Water Quality Arises

	Percent	Number
Water company	58.9%	205
City government	11.2	39
State government	2.6	9
Landlord	6.0	21
Water company and government	5.7	20
Two levels of government	1.1	4
Other combinations	14.3	25

This table gives a picture of whom the public holds responsible for the quality of their drinking water. The state government, which can assume primacy, was not seen at the time of the survey as being responsible for drinking water delivery. Nor did citizens volunteer with any frequency that a governmental agency at the federal level might be contacted.

Another survey question asked the citizens if they or anyone in their family had contacted anyone about the quality of their water. Only 30 respondents, or 7.0 percent, said they had. Of those 30, 71.9 percent had contacted the water company, 3.1 percent had contacted the city government, 6.3 percent had contacted their landlords, and 18.8 percent had contacted some other source or disclaimed knowledge.

In order to further explore citizens' perceptions of organizational and institutional roles in safe water delivery, they were asked to rate how much authority they thought given groups have in decisions about quality of public water. The results are given in Table 3.30.

Table 3.30

Citizens: Authority Groups Do Have in Drinking Water Decisions

	Great deal	Moderate	Little	None	Don't know
Federal government	19.4%	20.3%	15.9%	7.8%	36.5%
Water company	40.3	24.6	8.7	2.0	24.3
State Government	23.2	35.1	13.0	2.0	26.7
Scientists and experts	15.5	26.2	24.5	7.3	26.5
Citizens	9.0	23.2	28.1	16.8	22.9
Local government	22.6	35.9	13.6	4.9	22.9

From the Table 3.30 it appears that approximately one-fourth of the respondents were not sure how decision making authority is shared among these groups. The respondents felt citizens have little authority. It cannot be discovered from this table whether it is meant that citizens have direct authority, or indirect authority through elected representatives. This is clarified in Tables 3.31 and 3.32.

Table 3.31

Citizens: Policy Makers' Awareness of Public Opinion

Very aware	9.3%
Somewhat aware	64.1
Not at all aware	22.3
Don't know	4.3

Table 3.32

Citizens: Degree to Which Citizen Opinion Makes a Difference

Great deal	10.7%
Moderate amount	38.3
A little	34.5
No difference	13.0
Don't know	3.5

The amount of impact through decision makers that citizens feel they have is moderate. Even though citizens felt that decision makers are largely "somewhat aware" of their opinions, they were evenly split on whether this makes a moderate amount of or only a little difference.

This discussion is continued, following, where questions of who should have input into decisions are explored.

Citizens and Social Choice. When citizens were asked what groups should have authority in decisions about water quality, these were the responses:

Table 3.33

Citizens: Authority Groups Should Have in Drinking Water Decisions

	Federal Government	Water Company	State Government	Scientists and Experts	Citizens	Local Government
Great deal	18.5%	59.5%	38.3	42.6%	40.6%	46.7%
Moderate	27.5	28.3	42.3	35.7	32.8	38.3
Little	25.4	6.4	8.7	11.3	14.8	4.9
None	19.7	1.2	4.1	2.6	6.1	3.8
Don't know	9.0	4.6	6.7	7.8	5.8	6.4

When Table 3.33 is compared with Table 3.28, it appears there are interesting changes that citizens would make. (1) There is a drastic reduction in the percentage of respondents who say they don't know about authority. Citizens have opinions on who should have authority. (2) There is an increase for every group, except the federal government, in the "great deal of authority" category. That is, the citizens feel that their interests will best be served by a high level of interaction in the political arena. Yet they also apparently feel that the federal government exercises too much authority. (3) The role for citizens and scientists should be greatly expanded.

Several questions address the citizens' satisfaction with the quality and safety of the water supply. First, citizens were asked how many people with whom they usually talk are satisfied with the overall quality of water that comes from the tap (Table 3.34).

Table 3.34

Citizens: Proportion of Friends Satisfied With Water Quality

All	7.1%
Most	52.0
About half	17.3
A few	13.3
None	8.2
Don't know	2.0

Second, citizens were asked how many people with whom they usually talk are satisfied with the overall safety of water from the tap (Table 3.35).

Table 3.35

Citizens: Proportion of Friends Satisfied With Water Safety

All	17.7%
Most	43.8
About half	16.7
A few	11.5
None	3.1
Don't know	7.3

From these two tables (Table 3.34 and 3.35) it can be observed that more people report that all their friends are satisfied with the safety of their water than with the quality. It may be inferred that there are more discussions of water quality than safety, since fewer respondents disclaimed knowledge of quality than safety. That some citizens report that any of their friends have reservations concerning the safety of water may be significant in itself.

Citizens: Risk/Cost/Benefit Analysis. The citizens were asked to assess several aspects of their drinking water supply. Throughout this analysis attention is given to the percent of citizens who disclaim knowledge of assessment. This allows an inference of the proportion of citizens who were uncomfortable in making evaluations of the quality and safety of drinking water, and who might also be uncomfortable in making decisions on other technologically involved issues.

The citizen sample was asked if their drinking water is tested. Forty-five and one-half percent said yes, 22.2 percent said no, and 32.3 percent disclaimed knowledge. All three water suppliers test the water.

Next, citizens were asked to rate the quality, appearance, safety, and degree of hardness of their drinking water. The results are given in Tables 3.36 and 3.39.

Table 3.36

Citizens: Overall Quality of Drinking Water

Excellent	22.2%
Adequate	66.0
Less than adequate	5.5
Poor	5.8
Don't know	.6

Table 3.37

Citizens: Appearance or Color of Drinking Water

Excellent	28.5%
Adequate	57.9
Less than adequate	8.6
Poor	4.3
Don't know	.6

Table 3.38

Citizens: Safety of Drinking Water

Very safe	37.2%
Adequate	48.1
Somewhat unsafe	6.6
Very unsafe	2.0
Don't know	6.1

Table 3.39

Citizens: Hardness of Water

Very soft	1.4%
Soft	20.3
Hard	52.8
Very hard	21.7
Respondent disclaims knowledge	3.8

It appears that most citizens (more than 85 percent) are satisfied with the quality, appearance and safety of their drinking water.

Citizens: Risk/Cost/Benefit by City. The three water supplies chosen as case studies give an opportunity to compare types of water supply for quality, appearance, and safety. West Lafayette and Lafayette water supply sources are ground water; Indianapolis water is from a surface water supply. It is thought that significant differences in attitudes might occur because surface water supplies, being open, are more subject to contamination by chemical spills, upstream pollution, algae growth, and seasonal conditions. The Safe Drinking Water Act does not provide for any distinction in testing between surface and ground water. Rather, the testing schedule is determined by the size of the population served.

To see if citizens with different types of water supplies significantly differed on assessments of quality, safety, and appearance, crosstabulations were run.

Responses to the question below are the dependent variable in Table 3.40. "Would you say the appearance or color of the water that comes from the tap is excellent, adequate, less than adequate, or poor?" (Space was also provided for the response don't know.) The residents' city acts as the independent variable in Table 3.40.

Table 3.40

Citizens: Appearance of Drinking Water, By City

Appearance	West Lafayette
Excellent	26.1%
Adequate	59.5
Less than adequate	10.8
Poor	3.6
Don't know	0.0
	Lafayette
Excellent	24.6%
Adequate	58.5
Less than adequate	[illegible].5
Poor	7.6
Don't know	.8

(continued next page)

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Table 3.40

(continued)

Quality	Indianapolis
Excellent	34.7%
Adequate	55.9
Less than adequate	6.8
Poor	1.7
Don't know	.8

Chi^2 significance = .2926

From Table 3.40 it can be seen that the citizens did not differ significantly in their opinion about appearance with respect to city. However, Indianapolis responses fell more often in the excellent cell.

Table 3.41 is based upon responses to the question: "Would you say the overall quality of the water that comes from the tap in your home is excellent, adequate, less than adequate, or poor?"

Table 3.41

Citizens: Overall Quality of
Drinking Water, by City

Quality	West Lafayette
Excellent	20.7%
Adequate	64.0
Less than adequate	9.0
Poor	5.4
Don't know	.9
	Lafayette
Excellent	21.2%
Adequate	66.1
Less than adequate	4.2
Poor	8.5
Don't know	0.0
	Indianapolis
Excellent	24.6%
Adequate	67.8
Less than adequate	3.4
Poor	3.4
Don't know	.8

Chi^2 significance = .4231

A distribution similar to the previous table occurs here with Indianapolis responses clustering higher.

Table 3.42 tabulates responses to the question: "Would you say for drinking the water that comes from the tap is very safe, adequate, somewhat unsafe, or very unsafe?"

Table 3.42

Citizens: Safety of
Drinking Water, by City

Safety	West Lafayette
Very safe	41.4%
Adequate	45.0
Somewhat unsafe	4.5
Very unsafe	2.7
Don't know	6.3
	Lafayette
Very safe	32.2%
Adequate	48.3
Somewhat unsafe	10.2
Very unsafe	1.7
Don't know	7.6
	Indianapolis
Very safe	38.1%
Adequate	50.8
Somewhat unsafe	5.1
Very unsafe	1.7
Don't know	4.2

Chi^2 significance = .5706

Table 3.42 provides an interesting analysis. While citizens felt confident to assess the appearance and quality of their drinking water, when asked about the safety of their water, a technical assessment, citizens were more inclined not to answer. While less than one percent of those interviewed failed to offer an opinion on quality and appearance, between 5 and 10 percent were unwilling to offer an assessment of the safety of the water they drink.

The researchers were reluctant to alarm the respondents by asking direct questions concerning contamination of water supplies. Moreover, it is easy to create an issue where none exists by offering alternatives the respondent would not have volunteered. In attempting to assess whether or not citizens perceived risk, respondents were asked: "Is there anything in your drinking water when it comes from the tap?" Three quarters (74.4 percent) of the respondents said no, there was nothing in the water. A small proportion

(2.6 percent) said they did not know whether there was anything in the water. Only the 23 percent of respondents (79 of 344) who said something was in the water were asked first to name and then characterize the substances that might be in the water. Because the proportion who names one or more substances is quite low (less than 10 percent), Table 3.43 shows the number of respondents mentioning each subtance. Again, respondents were not given a list of possibilities, but were asked to volunteer the substances. Respondents who volunteered any substance were then asked "What is in the water that is desirable?", and "What is in the water that is undesirable?"

Table 3.43

Citizens: Substances Volunteered as Being Present in Drinking Water When it Comes From the Tap

Frequency with Which Substance was Mentioned

Calcium	6	Algae	1
Chlorine	26	Bacteria	1
Fluoride	15	Human waste	1
Heavy metals	5	Sand	1
Industrial chemicals	2	Specks	3
Iron	12	Chemicals	1
Potassium	1	Minerals	2
Salts	3	Other	8
Desirable Substances			
Calcium	1	Iron	1
Carcinogen	1	Salts	1
Chlorine	10	Iodine	1
Fluoride	14	Other	2
Undesirable Substances			
Number of Respondents = 28			
Calcium	4	Salts	4
Chlorine	7	Bugs	1
Fluoride	1	Human waste	1
Heavy metals	2	Specks	4
Industrial chemicals	3	Smell	1
Iron	10	Other	3

Then citizens were asked to characterize the undesirable substances they had volunteered, according to how important they felt it was to remove them from the water. Few persons (less than 1 percent) made any response to this question. For most citizens interviewed the safety of their drinking water is not a major issue.

The crosstabular analysis disproves our hypothesis that surface water will be perceived as inferior. Instead we find that citizen attitudes about drinking water are very similar across the three case studies. Interestingly enough Indianapolis drinking water has a larger percentage of respondents ranking it in the highest category two of the three times, and it has a smaller percentage of poor responses consistently.

Further, if the percentages in the excellent and adequate categories are summed, the percentage of those satisfied with their drinking water can be determined.

Citizens: Perceived Determinants of Quality of Water. The regulations promulgated as a result of the Safe Drinking Water Act require that anytime a water company delivers drinking water that exceeds the maximum allowable levels of contaminants notification to the public is required. The underlying assumption made by EPA is that once the public realizes the water company is in violation, they will be alerted and will demand that contamination levels are reduced to a safe level. The research presented in this paper, although not a predictive model, should give insight into discovering who might be mobilized into action and the arena in which a confrontation might take place.

In the present context (no notification of violation of maximum acceptable levels of contamination in water supply) we need to discover on what grounds the citizens assess the quality and safety of their water supply.

The quality of water was crosstabulated with appearance to yield Table 3.45.

Table 3.44

Citizens: Appearance, Quality and Safety of Drinking Water, Satisfaction by City.

(A)
APPEARANCE

	West Lafayette	Lafayette	Indianapolis
Satisfied	85.6%	83.1%	90.6%
Less than adequate	10.8	8.5	6.8
Poor	3.6	7.6	1.7
Don't know	0.0	.8	.8

(B)
OVERALL QUALITY

	West Lafayette	Lafayette	Indianapolis
Satisfied	84.7%	87.3%	92.4%
Less than adequate	9.0	4.2	3.4
Poor	5.4	8.5	3.4
Don't know	.9	0.0	.8

(C)
SAFETY

	West Lafayette	Lafayette	Indianapolis
Satisfied	86.4%	80.5%	88.9
Less than adequate	4.5	10.2	5.1
Poor	2.7	1.7	1.7
Don't know	6.3	7.6	4.2

Table 3.45

Citizens: Drinking Water Quality by Appearance

	APPEARANCE			
Quality	Excellent	Adequate	Less than Adq.	Poor
Excellent	59.6%	8.0%	0.0%	13.3%
Adequate	38.4	87.1	43.3	13.3
Less than Adequate	2.0	1.5	33.3	26.7
Poor	0.0	3.0	23.3	46.7

Chi^2 significance = .001

For most people appearance predicts the quality of the water supply. In the next table the degree of hardness is crosstabulated with quality to determine whether it also predicts quality.

Table 3.46

Citizens: Drinking Water Quality by Degree of Hardness

	HARDNESS			
Quality	Very soft	Soft	Hard	Very hard
Excellent	40.0%	32.9%	22.0%	12.0%
Adequate	60.0	62.9	67.6	62.7
Less than adequate	0.0	1.4	4.9	12.0
Poor	0.0	1.4	4.9	13.3

Chi^2 significance = .0201

Here, degree of hardness is not as strong a predictor of quality as appearance. In both Tables 3.45 and 3.46 a moderate percentage of those who rank their drinking water as adequate rank its hardness and appearance as less than adequate. This data does not make it possible to delve further into other reasons for deeming water that has a less than adequate or poor rating for appearance and hardness as being of adequate quality.

This leads us to an attempt to discover how citizens assess the safety of their drinking water. Safety was cross-tabulated with quality, appearance, and presence or lack of substances in drinking water. No relationship was found for the last variable. Quality seems to be the best predictor of safety accounted for by the data. The output with raw scores is given below in Table 3.47.

From all the research it can be concluded that most citizens assess the safety of their water by the quality of the water that comes from the tap. Quality is closely associated with the appearance. The fact that perceptions of what might be in the water did not have a significant relationship with quality is important. This leads to the inference that even when citizens are told their water contains unacceptable levels of substances, they will be unwilling to assess the water as unsafe as long as the appearance remains the same. This seems to be borne out by the recent experience of pollution of the Ohio River. Citizens continued to drink the water even after they were told contamination had reached an unacceptable level.

Table 3.47

Citizens: Drinking Water Safety by Quality

	Quality				
Safety	Excellent	Adequate	Less than Adq.	Poor	Dk
Very safe	51	77	0	1	0
Adequate	20	132	8	7	0
Somewhat unsafe	2	9	7	5	0
Very unsafe	0	2	2	3	0
Dk	4	9	2	4	2

Chi^2 significance = .0000

Section 4 Summary

How decisions are and should be made in a democratic society has long been a topic of debate. Political scientists and those in other disciplines have wrestled with the theoretical aspects, while politicians and other decision makers have wrestled with the practical aspects. Problems for those involved in defining democratic theory center around the dynamic interface between majority and minority rights and opinions. Those who choose to develop descriptive models to ascertain how decisions are made in specific cases (international affairs, environment, civil rights) may require statistical quantitative techniques. The decision maker faces the problem of weighing conflicting points of view. It is doubtful that the public has a unified known or knowable choice on any given area of concern in the public arena. Further, disagreement exists on what issues should be addressed in the public sector and what levels of the federal system should deal with specific issues.

This study has assumed that improved decision making can be rendered if social choice on specific issues is explored, using quantitative techniques. That is, a systematic exploration of citizens' attitudes can provide the decision-maker with reliable and important information.

Further, this study has sought to explore how decisions are made by both citizens and decision makers in technological situations defined as low risk-high consequence. Again, to relate this concept to drinking water it can be stated that the chances of death or serious illness due to contamination of the drinking water supply are minimal ($p < .00000001$). However, should should contamination of the water supply occur the consequences would negatively affect many persons.

This study pursues an important task in that the expanded use of technology has caused many such situations of low risk-high consequences. Questions of what role is appropriate for the government in regulating technology arise. Further, if regulation should occur, who should determine where the danger lies? Is it necessary to have experts in that field make the decision?

This study has surveyed both decision makers and citizens in Indiana to compare and contrast their opinions on regulation of drinking water supplies. The history of drinking water regulation showed that impetus for stricter standards has come from technicians in the past. Through interviews it was determined that few citizens are actively involved in the issue of drinking water. However, the federal government is involved in administering the Safe Drinking Water Act through the states. Currently, SDW standards do not differ in any significant way from the 1962 Public Health Service standards; but research on carcinogenic substances may lead to inclusion of more restrictive legislation.

This study has also attempted to determine who the participants in the regulation of drinking water supplies are at the federal level and in the state of Indiana. It was found that public as well as private interest groups are active.

This study has explored the perceptions of citizens and decision makers concerning the risks associated with drinking water supplies. Coupled with this inquiry are considerations of benefit and cost. That is, if citizens see prohibitive risks, can they calculate the associated costs of stricter standards to arrive at risk/benefit ratios?

Finally, the special topics pursued by some members of the research team more fully explored the activity level of citizens, their social choices in the case of their drinking water supplies, and the juggling of the risk/cost/benefit quotients in a technological situation.

Safe Drinking Water
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APPENDIX N.

ON HERBICIDE ORANGE CASE STUDY

Decision Processes in the Contemplated Disposal of Herbicide Orange by Soil Bio-degradation in Utah.

Anthony Wachinski, Elizabeth Farris and William Cheney

Citizen and Elite Attitudes Toward the Disposal of Herbicide Orange in the State of Utah.

Michael Bennett and Sara Fash.

Abstract

This case study sought to compare perceptions of risk and benefits of parties involved in the safe and economical disposition of certain herbicidal materials in the possession of the United States Air Force. More specifically, the study focused on the decision processes to not pursue an avenue of disposal utilizing a soil incorporation technique on Federal lands in the deserts of northern Utah. In addition to those directly involved in the decision (i.e., Air Force officials, members of regulatory governmental and state agencies, as well as members of the scientific community), the perceptions of the disposal plan by a random sample of 200 residents living in adjoining counties were elicited. Citizenry reactions to aspects of the project were obtained in response to a series of structured questions asked during a 5 minute telephone interview.

Overview

Herbicide ORANGE is the military designation for a fifty-fifty combination of the n-butyl esters (chemical variants) of two commercially available herbicides*, 2,4-dichlorophenoyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). Both 2,4-D and 2,4,5-T belong to a group of synthetic organic compounds called the "phenoxy" herbicides which are well established selective herbicides widely used in crop production and the management of forests, ranges, and industrial sites.[1] The phenoxy herbicides are especially useful[2] because of their selectivity (i.e., they kill most broad leaf plants but do not kill grasses or grain crops), their potency (many species of weeds are controlled by less than one pound of active ingredient per acre), their easiness to use, and their moderate toxicity to man, domestic animals, and wildlife. During the 1960's the herbicidal formulation designated ORANGE was employed as a defoliant in the Southeast Asia conflict to protect troops, shipping, and aircraft from ambush from the jungle cover and to deny guerillas sources of food from their remote garden plots.[3] The formulation was called ORANGE because of the orange band around the centers of the 55-gallon drums in which it was transported.

Protests from the public sector as well as members of the scientific community denouncing the use of defoliants in the Viet Nam conflict as "chemical warfare" were culminated in 1969 when South

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*A herbicide is generally defined as a substance used to inhibit the growth of or kill unwanted plants, usually weeds. The term defoliant refers to a chemical spray or dust applied to plants to cause the leaves to drop prematurely.

Vietnamese newspapers reported increased occurrences of birth defects. Later that same year, a study released by the Bionetics Research Laboratory, Litton Industries, Inc., implicating 2,4,5-T as teratogenic precipitated a veritable epidemic of high level discussions which were unable to resolve the issue of 2,4,5-T's risk to human pregnancy. As a result, restrictions and ultimately suspension of the military use of 2,4,5-T (Herbicide Orange) occurred. These actions left the Air Force with $16 million worth of herbicide, some 2.3 million gallons. In 1971, the Department of Defense directed that the herbicide material be disposed in an ecologically safe manner.

This case study sought to focus on those decision processes involved in the Air Force not pursuing an avenue of disposal utilizing a soil incorporation technique on Federal lands in the desert of northern Utah. In addition, those events surrounding the controversies of the most notorious pesticide since DDT are put in perspective. The Herbicide Orange controversy is a classical example of a political issue with substantial scientific content, we hope to carefully "frame" the scientific issue so that the answer it provides is useful in consideration of the broader political issue.

Historical Perspectus

In May, 1973, the Governor of Utah, in a letter to Dr. Billy E. Welch, Special Assistant for Environmental Quality, Office of the Assistant Secretary of the Air Force, Installations Logistics, formally "resisted" an Air Force proposal to dispose of some 2.3 million gallons of Herbicide Orange on federal lands in the deserts of northern Utah. Governor Rampton said in his letter that it was his duty to resist the action based on his advisors' scientific ability to analyze the evidence[4,5]; however, some feel that the Governor's decision was made immediately upon hearing the proposal, and any scientific evidence was provided after the fact to substantiate his decision. When one considers the possible ramifications of his decision on Utah's economy (70 percent of the land within the state boundary is owned by the federal government and a substantial portion of the state's revenue is provided by military installations within the state), it would appear that prior events concerning Herbicide Orange, chemical/biological warfare, and previous military operations had significantly impacted on the Governor.

The discovery of 2,4-D and 2,4,5-T, i.e., substituted phenoxyacetic acids, was serindipity in nature. Botanists studying the useful applications of a newly discovered group of compounds which regulated growth in plants, noted that when too large of a dose of these substances was applied, the plant would die (the most powerful plant regulation was 2,4-D.) One man, Dr. E. J. Kraus, then head of the Botany Department of the University of Chicago, envisaged application of these growth regulators as economical, effective replacements for contact* herbicides still being used by some people to destroy weeds in grain fields. Successful testing of these substances, including 2,4-D in late 1942 led Kraus to suggest to the National Academy of Science and the National Research Council that the toxic properties of the growth regulators might have military potential in the destruction of crops or in the limitation of crop production. Based on the findings of Kraus, the Army

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*Man had known that certain salts would kill weeds since the late 1800's; however, these salts only burned or poisoned that portion of the plant that they touched, were very expensive to use and inconsistent in killing weeds.

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undertook an extensive research program to identify and field test suitable herbicidal formulations for military use. The work was assigned to the center for research and testing of the newly established biological warfare program at Camp Detrick (now Fort Detrick*, Maryland). Nearly 1100 substances were investigated including 2,4-D and 2,4,5-T.[7]

The research at Fort Detrick was directed at developing herbicides for possible use in the "island-hopping" campaign of General MacArthur to replace the standard procedure of clearing land areas of foliage by saturation with high explosives. World War II ended before any of the chemicals were actually used in an active theater. However, the feasibility of using herbicides for large scale defoliation had been established.

In April of 1944, while war oriented work with herbicides was underway at Fort Detrick, researchers at the United States Department of Agriculture (USDA) research laboratories in Beltsville, Maryland, were investigating the use of 2,4-D as a weed killer; and in June of that year, two former students of Kraus suggested publicly for the first time that 2,4-D had "some importance in connection with the differential killing of weeds."[8] Three months later the effectiveness of 2,4, 5-T was reported.[9]

These herbicides, i.e., 2,4-D and 2,4,5-T were especially favorable for use in agriculture. In addition to being non-corrosive, easy to produce, and extremely effective (an extremely small amount placed on a single leaf was translocated throughout the plant system, killing even the roots), they were selectively toxic to plants, i.e., they would cause death to some plants, generally of the dicotyledenous or broad-leaved type, but would not affect the growth of more resistant monocotyledonous plants such as grasses, making them ideal as selective weed killers in the production of cereal grains, grasslands, and coniferous forests. Also, tests for toxicity in man and animals at that time proved low enough to make the chemical acceptable for public use. Public interest in the chemical was intense as other reports were published.* Then in 1945, the American Chemical Paint Co. marketed the first systemic herbicide under the brand name "Weedone".[10] Other chemical companies were soon licensed to produce this and a similar chemical resulting in tremendous growth of the chemical industry synthesizing such compounds.

The cost per pound of 2,4-D used for early experimental work was $12.50; in 1944, however, the price per pound declined to less than $3.00. By 1950, 2,4-D was selling for $0.50 per pound[11]; today the n-butyl ester of 2,4-D is selling for $0.375 a pound. 2,4,5-T, on the other hand, is more expensive, the n-butyl ester going for $0.99 per pound, 1975 prices.[12] Production of 2,4-D increased from 917,000 pounds in 1945 to 45 million pounds in 1971. Combined usage of 2,4-D and 2,4,5-T approached 96.8 million pounds in 1968[13] and over 450 million pounds in 1973.[14] The phenoxy herbicides 2,4-D and 2,4,5-T accounted for approximately 87 percent of the total herbicide usage in the United States in 1973. It is important to recognize the enormous quantities and widespread areas of use of these chemicals in the United States to understand the controversy surrounding them.

In the post-war program, Fort Detrick continued to examine defoliants with the more promising being tested on vegetation in the United States and Puerto Rico. One of the more significant tests occurred in 1959 at Camp Drum, New York, when aerial application of a mixture of undiluted esters (chemical variants) of 2,4-D and 2,4,5-T at 0.75 gallons per acre denuded the trees over an area of four square miles.[15] This mixture of 2,4-D and 2,4,5-T subsequently became the military herbicide formulation of choice for defoliation operations in South Vietnam.

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*For a complete history, see Gale E. Peterson's "The Discovery and Development of 2,4-D", Agricultural History, 41: 243-253. 1967.

In 1961, the United States, in response to a request from South Vietnam to undertake trials of defoliants for use against guerilla forces,[16] shipped a variety of potential herbicidal agents, including ORANGE. Fort Detrick personnel conducted aerial and ground spray tests establishing the effectiveness of the Orange Formulation against the majority of the vegetative species encountered in South Vietnam. On January 1, 1962, plans were announced for the operational use of herbicides to counter guerilla activities.[17] As the author of the history of 2,4-D concluded:

> Ironically, 20 years after Kraus had suggested it to the National Academy of Sciences, 2,4-D became a tool of . . . warfare. * * * Developed for war, but designed for agriculture, the U.S. military at last found application for its contribution to the development and testing of 2,4-D.[18]

The Republic of Vietnam managed all of the defoliation operations and the United States operationally supported the programs. Although requests for herbicide missions could originate from either American or Vietnamese sources, the Vietnamese governments had to approve all targets. Although ORANGE was the most common formulation used, several herbicides were used: Blue, a clear mixture of sodium cacodylate and demethylarsenic acid with a five percent surfactant, and White, a dark-colored mixture of 4 amino - 3,5,6 - trichloropicolinic acid and 2,4-D.[19] Of the three, Herbicide Orange was preferred since it could be used for both defoliation and crop control, and produced a visible response in four to seven days.

From 1945 to 1962, the use of 2,4-D and 2,4,5-T by ranchers, foresters, and the American farmer continued without controversy. Apprehension towards 2,4-D and 2,4,5-T, as well as pesticides in general was triggered by the appearance in 1962 of an influential popular book by Rachel Carson, titled Silent Spring. Miss Carson painted a dim, and gloomy picture of 2,4-D and 2,4,5-T implicating them as toxins and potential mutagens:

> The most widely used herbicides are 2,4-D, 2,4,5-T, and related compounds. Whether or not these are actually toxic is a matter of controversy. People spraying their lawns with 2,4-D and becoming wet with spray have occassionally developed severe neuritis and even paralysis. *** It has been shown experimentally to disturb the basic physiological process of respiration in the cell, and to initiate X-rays in damaging the chromosomes (p. 75).

Miss Carson's book precipitated numerous reports and studies dealing with pesticides and herbicides; particular attention was paid to evaluating ecological consequences, and contamination of the environment.

In 1964, the National Cancer Institute, an arm of the National Institute of Health, undertook through a contract with the Bionetics Research Laboratories, Litton Industries Incorporated, a general screening of a number of pesticides, including 2,4-D and 2,4,5-T and industrial chemicals for carcinogenicity, teratogenicity, and mutagenicity, i.e., would these chemicals cause cancer, deform the fetus, or bring unintended developments in human growth? The inferences drawn from the study,[20] completed in 1966, were that 2,4,5-T appeared to provoke a higher than expected level of fetal death and fetal abnormality in rats and mice at the dosages used; there also appeared to be a dose-response relationship over the range of doses used. However, the sample of 2, 4, 5-T used contained about 27 parts per million (ppm) 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD), a known highly toxic by product in the manufacture of 2, 4, 5-T.[21] This study also showed 2, 4-D as potentially dangerous and needing further study. The National Cancer Institute waited until September of 1968, after more definitive tests, to inform the Food and Drug Administration (FDA) and the Agricultural and Defense Departments.

On October 29, 1969, the President's Science Advisor, Dr. Lee DuBridge, learned that the Washington Post would publish the results of the Bionetics Study the following day. Dr. DuBridge called the Washington Post to say that the White House was placing a ban on the use of 2, 4, 5-T on agricultural crops in the United States and would only use 2, 4, 5-T in areas in Vietnam remote from population. The press release had followed a release by the Saigon newspaper, Tin Sang in June of that year, reporting a "fetal deformity catastrophe" in one of the provinces caused by the use of defoliants. The paper carried pictures of the deformed fetuses. Other papers carried similar stories in June, but reported in July that the occurrence of malformed infants were no greater than anywhere else.[22]

The announcement elicited far reaching reactions from governmental agencies, segments of the scientific community, various lay groups concerned with environmental problems, and from the public community media. National concern was elicited particularly about 2, 4-D and 2, 4, 5-T because these two chemicals had been used in enormous quantities and over widespread areas without detailed knowledge of chronic toxicity or other side effects. One of the key requirements established by the Fort Detrick team in 1961 was that "the chemicals must be nontoxic to humans in handling, in exposure to dissemination equipment (either by direct contact or by the respiratory route, or in the consumption of edible produce). This requirement was satisfied by the fact that both 2, 4-D and 2, 4, 5-T were registered for use in the United States by the Department of Agriculture. It was these assumptions that prompted the Defense Department to declare to Congressman Richard McCarthy in March of 1965, that "the herbicides used in Vietnam were nontoxic and not dangerous to man or animal life."[23] But back in 1959 the National Academy of Science-National Research Council had issued a report on standards that were to be used in testing chemicals such as pesticides and herbicides for their carcinogenic effects, terotegenic effects, and mutagenic effects.[24] Although the government had regulations requiring these factors be evaluated before a chemical was licensed for use, they were not enforced.

Government-sponsored panels for experts, special commissions set up by scientific organizations, hearings before subcommittees of the United States Senate, and conferences attended by representatives from industry, government, and universities examined available data and heard expert opinion. None of these groups, however, were able to provide a generally acceptable answer to the central question of whether 2, 4, 5-T as currently produced and used, constituted a risk to human pregnancy.

In early 1970, additional animal studies by the Dow Chemical Company and the National Insitute of Environmental Health Sciences (NIEHS) established TCDD as a probable contributing teratogen in the Bionetics Study.[25] Further studies by the Dow Chemical Company and NIEHS with samples of purified 2, 4, 5-T showed that purified 2, 4, 5-T was not teratogenic in rats, but was teratogenic in mice at reported dosage levels. Studies conducted by the Department of Agriculture on pregnant mice fed the same dosage per kilogram of body weight resulted in no abnormal fetuses.[26] At this time there were no data on the effects of 2, 4, 5-T on human beings, but the apparent teratogenic potential of 2, 4, 5-T and TCDD in mice led the Secretary of Health, Education and Welfare (HEW) to advise the Secretary of Agriculture that: "In spite of these uncertainties, the Surgeon General feels that a prudent course of action must be based on the decision that exposure to this herbicide may present an imminent hazard to women of child-bearing age." Accordingly on the following day, the Secretaries of Agriculture, HEW, and Interior jointly announced the suspension of 2, 4, 5-T for all uses around the home, receeation areas, and similar sites and in all uses intended for human consumption. An intention to cancel* registered uses of non-liquid formulations of 2, 4, 5-T around the home and on all food crops was also announced. The Dow Chemical Company, Hercules Incorporated, and Amchem initiated action to contest the cancellation in registered uses for the control of weeds in rice crops. The Secretary of the Interior indicated that he would ban the use of 2, 4, 5-T on all land managed by that Department. The Assistant Secretary of Defense in November 1970 temporarily suspended all use of Herbicide Orange in Vietnam.

By January, 1971, the newly formed Environmental Protection Agency (EPA) inherited the 2, 4, 5-T problem, and one of its earliest functions was to activate that same month a nine-man committee selected from a list of scientists submitted by the National Academy of Science. Charged with the responsibility of reviewing all available evidence on the teratogenic potential of 2, 4, 5-T, this scientific Advisory Committee had four months to submit their findings to the William D. Ruckelshaus, the newly appointed Administrator. In May of 1971, the report which represented a consensus of eight members of the nine man committee was submitted. Dr. Theodore Sterling, the only member that was not a qualified bio-medical scientist (Professor of Applied Mathematics and Computer Science), appended the report with a long list of objections and exceptions to the report.

The report was immediately leaked to *Nature* and *Science* (two scientific news magazines), *in spite* of the regulations under which the committee operated. Highly critical magazine articles appeared during the summer based *only* on Dr. Sterling's objections; no more than passing reference was made to the conclusions and recommendations of the eight toxicologists, botanists, and biochemists who had *concurred* in the main report.[27]

As a result of the temporary suspension of herbicide use in Vietnam, a total of 833,855 gallons of Orange were in storage in June 1970, and approximately 1.5 million gallons were being stored in Vietnam. A study by the Joint Chiefs of Staff to the Office of the Secretary of Defense in April 1971 recommended the herbicide be used as intended, but in September, as a result of EPA's determinations of acceptable levels of TCDD, the Secretary of Defense directed the Joint Chiefs of Staff to return all of the herbicide in Southeast Asia to the United States and subsequently arrange for incineration facilities.[28]

Studies were initiated to establish the monitoring standards and techniques needed to insure that incineration would be environmentally safe, and in January, 1972, a draft environmental statement was distributed to all involved agencies including those in Texas and Illinois, where the commercial incineration facilities to be used were located. Reaction to the environmental statement resulted in unfavorable press releases and subsequent denial of permission to incinerate in both Illinois and Texas.

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*Suspension of a pesticide immediately halts its sale in interstate commerce; intent to cancel a registration allows the sale and use of the compound pending review of the announcement as published in the Federal Resister. Appeals can further extend the cancellation.

This adverse reaction prompted the Assistant Secretary of the Air Force for Installations and Logistics to explore *all disposal* options and to move all Vietnam herbicide stocks to Johnston Island in the South Pacific until an *acceptable* method of disposal could be developed. The herbicides were moved to Johnston Island in April of 1972; the total herbicide inventory was approximately 2.3 million gallons stored in 40,000 55-gallon steel drums. Both the herbicide and the drums were to be disposed.

That same month, the Air Force Logistics Command began an indepth investigation into the feasibility of use, incineration, soil biodegradation, fractionation, chlorinolysis and reprocessing as major disposal options. An *Ad hoc* Committee (of the Air Force Scientific Advisory Board) on the Disposal of Herbicide Orange was established to review all data and make recommendations to a project manager. (An in-depth description of all options can be found in the Final Environmental Impact Statement on "Disposition of Herbicide Orange by Incineration, November, 1974").

During the early years of the Herbicide Orange controversy, Circa 1968, an event occurred in the State of Utah that was probably the single most significant influence on the Governor of Utah's decision to "resist" the Air Forces' proposal.

At that time, the Dugway Proving Grounds was the Army's principal center for evaluating newer chemical and biological weapons systems; it was located directly south of the Air Force bombing and test range later considered for the disposal of ORANGE, and encompassed some 850,000 acres. According to Utah Senator Frank E. Moss,[29] 320 gallons of nerve agent sprayed from "a high-speed aircraft" over an area "27 miles from the nearest grazing lands were presumably carried over the grazing lands and precipitated by rain showers. Sheep in the area ate the snow and evidently ingested sufficient amounts of the organophosphate compound to cause their death.[30,31]

Implications of the incident are apparent in many areas: (1) The people of Utah established an availability bias against "chemical agents" (by 1968, Herbicide Orange was implicated as a chemical agent). (2) Serious doubt was cast upon military safety procedures involving "chemical agents". (3) The initial reluctance of the Army to admit any connection between their testing and the sheep-kill further extended an air-of-caution towards the military. (4) The Governor of Utah, as well as all of the State Board of Health, and Senator Moss were involved in the "sheep incident" and later the Air Force proposal.

On March 9. 1973, the Assistant Secretary of the Air Force, together with the Herbicide Orange Project Manager and the General Officer of neighboring Hill Air Force Base visited the Governor and one of his assistants to propose the use of federal lands in Utah as an option for disposing of some 2.3 million gallons of Herbicide Orange. Dr. Welch explained in detail to the Governor the various options being considered for the disposal, giving the pro's and con's and identifying the unknowns.

The Players and Their Roles

The processes involved in the siting of a (one-time) hazardous material disposal site are not significantly unlike those involved in the siting of a nuclear power plant in which the low cost electrical power is used elsewhere. A traditional cost-benefit analysis, in this instance by the Air Force, would weigh the benefits (as they see them) of "getting rid" of a dangerous substance, savings in storage costs (in this case, it was costing about $10,000/month just to keep the herbicide), against the risk-costs (as they see them) of probabilities of release of the herbicide during transportation (this could involve millions in law suits) displacement of 2000 acres of low-use land for many years), political ramifications (in case of a non-explainable rise in malformed infants anywhere in the area, be it mammal or human). A positive siting decision (by the Air Force in this case) is generally based on minimum political opposition from the state involved, assuming all technical questions are answered.

The view from the perspective of both citizens and state officials in a potentially affected community usually reflect a different notion of the costs and benefits accruing from such a proposal. A "stigma" of having their area, or state, labelled as a "dumping" ground and the low, but very real probability of some unknown event causing illness, deformities of some sort, or death. (Just 6 years previous, over 4500 sheep died "horribly" due to a "low-risk" event from a "similar agent"), no increase in the already low tax base of the state (in this case, Utah) or any significant increase in jobs (disposal operations would most likely be accomplished by Air Force personnel using government equipment). Thus, the citizens may (rationally) see themselves as bearing virtually all of the risk-costs while reaping zero benefits of the disposal site (note that things may be significantly different if the operation were not a "one time" event but a waste disposal repository.

The federal taxpayers (about 1/2 percent live in Utah) would stand to gain significantly by the action since their tax dollars were being used to "keep" the herbicide and this option of disposal appeared to cost the least of those investigated at the time. It was generally agreed that the herbicide should be disposed[30] (a result of the high level of emotion that surrounded all aspects of the Vietnam war, the human birth defects had resulted from defoliation in Vietnam followed by the Bionetics Study, the widespread public concern at that time, i.e., the early environmental movement, about many aspects of environmental change and their effects on "ecology", and finally overzealous and sometimes irresponsible efforts by some agencies and individuals to influence the public for personal gain or even sincere but ill-founded reasons). The risk-costs are not apparent to all, but economic ramifications could extend in the form of price increases of beef, grain, lumber, and even electrical power, if the disposal would set a precedent in the 2, 4 5-T controversy. A very small risk exists, that should an incident occur during the transportation of Orange to Utah that it could conceivably occur in an area that could directly affect taxpayers, yet this view from the perspective of the federal taxpayer is one of apathy.

The Environmental Protection Agency (EPA) inherited in 1970 all functions with regard to pesticide registration and other toxic substances previously under jurisdiction of USDA, HEW and FDA. Its involvement with the disposal decisions in Utah, however, were indirect at best. In answering the questions of whether 2, 4, 5-T posed a threat to human pregnancy, the EPA would determine what portion of the Air Force stocks would be disposed. The EPA would neither benefit nor lose, regardless of the Air Force decision in Utah, and thus played an insignificant role in the analysis.

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CASE STUDY ON HERBICIDE ORANGE, CONTINUED:

Citizen and Elite Attitudes Toward the Disposal of Herbicide Orange in the State of Utah

Michael Bennett and Sara Fash

Background and Objectives

In 1970 the use of Herbicide Orange was suspended after experimentation found it to be teratogenic in animals. The United States Air Force had (and still had as of 1977) the responsibility for the disposal of 2.3 million gallons of the herbicide. One proposal for disposal was through soil-degradation in Utah. This study attempts to examine the salient variables involved in the risk perceptions of elites (groups with potential for high decision input) and of Utah citizens.

Methodology

Elites, those who had power in the decision ranging from veto (Governor of Utah) to political and social input (the media), were divided into four groups: the Air Force, scientists, media, and Utah state officials. Persons in these groups were interviewed at length and filled out a scale rating their perception of the likelihood, seriousness, and importance of several possible consequences of the soil-degradation plan in Utah (Appendix C to main report.) Those not responding to the scales were independently rated by two judges (Bennett and Fash) based on their interview transcripts. Data from the Environmental Protection Agency were deleted, since comments were not able to be scaled.

A random sample of 220 citizens was drawn from the varying proximal areas of Salt Lake City, Ogden, and Tooele. These citizens responded to a series of 31 questions in a structured telephone interview (Appendix G, to main report.) The interview gathered information at two levels since citizens were first asked their opinion on the matter and interviewees with more knowledge were asked depth questions on specific potential outcomes. Many citizens didn't know or refused to respond to questions which cause a considerable reduction in sample size. These blanks and "don't knows" were treated as missing data in analysis.

All groups were asked to rate the likelihood of occurence, the importance of different variables in shaping their opinions, and the seriousness of different possible consequences of burial.

Results

Crosstabulation of attitude toward burial and the suggested consequences showed a general movement toward alignment but actual significance was found only with elite data under the areas of seriousness of water contamination, long range effects and human birth defects, likelihood of water contamination, skin reactions, and animal birth defects, and importance of water contamination long range effects and human birth defects. (See figures 1-4).

One way analysis of variance by citizen group revealed no significant between-group variance. Consequently, citizen groups were combined in subsequent analysis. Analysis of elite variance in the area of likelihood of water contaminations (F=.000), seriousness of water contamination (F=.005), importance of water contamination (F=.001), and importance of long range effects (F=.009).

After combining citizen groups, analysis was performed using a Student-Newman-Keuls procedure. Several significant subsets between groups were isolated in the areas of likelihood and seriousness but no significance cuuld be assigned to any analyses of importance. The citizen group was significantly different from the group consisting of scientists, Air Force, Utah, and the media (F=.000) in the likelihood of crop damage and the likelihood of animal birth defects. The Air Force, Scientists and Utah differed from means of scientists, Utah and the media. Citizens were a significant subset by themselves. Media and citizens were a significant subset in regard to likelihood of human birth defects. (F=.001) No significant subsets were evident in the areas of likelihood of long range effect or attitude toward burial.

Subsets were generated under the seriousness ratings only in the areas of crop damage and water contamination. Seriousness of crop damage (F=.002) yielded subsets of Utah and citizens (very serious) against scientists, the Air Force, media and Utah. Seriousness of water contamination was significant at the .000 level and two subsets, media, citizen, Utah, versus scientists, the Air Force, media were isolated. While having a significant F (.010), no subsets were found under seriousness of long range effects. No index of importance was found to have a significant F.

Discussion

Although citizens appeared to be very inconsistent in their ratings except for the strongly opposed group, (see tables), several generalizations are possible. The Air Force and scientists were much less concerned with the potential consequences than were the media and Utah as is shown in the subgroups under likelihood of water contamination and animal birth defects. All elites generally felt crop damage unlikely and not very serious as opposed to citizens. Water contamination concerns seemed to polarize Utah, the media, and citizens against the Air Force and scientists. These trends may perhaps be explained in two ways. First, the herbicide case presents many potential negative outcomes while offering few, if any (patriotism?), benefits to Utah citizens. Second, the media, citizens and state officials are much closer to the outcomes. Citizens and the media seem to have few solid facts while scientists keep stressing that there is too little information to make a decision on the various risks. Finally, the higher the ratings of likelihood and seriousness of the outcome, the more opposed were the positions on the plan to dispose of the herbicide.

The biggest problem with this analysis is the lack of responses from citizens and elites. Citizens could be excused for forgetting the issue after its resolve. Elites could either be genuinely hesitant to reply due to lack of scientific verification of facts, or simply afraid of having their remarks attributed to them for political or social reasons.

CITIZEN ATTITUDE TOWARD BURIAL

In Favor	6.4%
Don't Know	34.6%
Opposed	43.6%
Strongly Opposed	15.4%

(78 Responses)

ELITE

Group Identification by Attitude

	In Favor	Don't Know	Opposed	Strongly Opposed
Air Force	50.0%	25.0%	25.0%	
Scientists	50.0	25.0	25.0	
Utah		33.3	66.7	
Media	33.3		33.3	33.3%

x^2= .0323 None Missing

CITIZEN

Group Identification by Attitude

	In Favor	Don't Know	Opposed	Strongly Opposed
Tooele	26.1%	30.4%	30.4%	13.0%
Ogden		31.6	57.9	10.5
SLC	13.0	26.1	34.8	26.1

x^2= .1592 None Missing

WATER CONTAMINATION LIKELIHOOD

1=Extremely Unlikely 9=Extremely Likely

ELITES

	1	3	7	9
In Favor	100.0			
Don't Know	33.3	16.7	50.0	
Opposed	42.9	14.3	14.3	28.6
Strongly Opposed			100.0	

x^2= .0278 7 Missing

CITIZENS

	1	3	7	9
In Favor	20.0	40.0	40.0	
Don't Know		20.0	60.0	20.0
Opposed		18.8	62.5	18.8
Strongly Opposed		14.3	42.9	42.9

x^2= .2807 27 Missing

	1	3	7	9
Air Force	100.0			
Scientists	75.0	25.0		
Utah		20.0	80.0	
Media	33.3		33.3	33.3

x^2= .0043 7 Missing

	1	3	7	9
Tooele	8.3	33.3	33.3	25.0
Odgen		8.3	83.3	8.3
SLC		21.4	50.0	28.6

x^2= .2265 27 Missing

WATER CONTAMINATION SERIOUSNESS

1=Not at all Serious 9=Extremely Serious

ELITES

	1	3	7	9
In Favor	75.0	25.0		
Don't Know	100.0			
Opposed	8.3		66.7	25.0
Strongly Opposed				

x^2= .0016 7 Missing

CITIZENS

	1	3	7	9
In Favor	25.0	50.0		25.0
Don't Know		14.3	42.9	42.9
Opposed	6.3	6.3	37.5	50.0
Strongly Opposed			33.3	66.7

x^2= .1559 29 Missing

	1	3	7	9
Air Force	75.0		12.5	12.5
Scientists	50.0	50.0		
Utah			71.4	28.6
Media	50.0		50.0	

x^2= .0080 7 Missing

	1	3	7	9
Tooele	9.1	9.1	27.3	54.5
Ogden	10.0		40.0	50.0
SLC		20.0	33.3	46.7

x^2= .6783 29 Missing

LIKELIHOOD OF HUMAN BIRTH DEFECTS

1=Extremely Unlikely 9=Extremely Likely

ELITES

	1	3	7	9
In Favor	100.0			
Don't Know	100.0			
Opposed	60.0	20.0		20.0
Strongly Opposed	100.0			

x^2= .3078 5 Missing

CITIZENS

	1	3	7	9
In Favor	50.0		50.0	
Don't Know	50.0		50.0	
Opposed		20.0	80.0	
Strongly Opposed	25.0		50.0	25.0

x^2= .6666 52 Missing

	1	3	7	9
Air Force	100.0			
Scientists	100.0			
Utah	71.4	28.6		
Media	66.7			33.3

x^2= .0579 5 Missing

	1	3	7	9
Tooele		33.3	33.3	33.3
Ogden			100.0	
SLC	33.3		66.7	

x^2= .1932 52 Missing

SERIOUSNESS OF HUMAN BIRTH DEFECTS

1=Not at all Serious 9=Extremely Serious

	1	3	7	9
In Favor	33.3			66.7
Don't Know	66.7			33.3
Opposed	10.0	20.0		70.0
Strongly Opposed			100.0	

x^2= .0015 9 Missing

	1	3	7	9
In Favor			100.0	
Don't Know	50.0	50.0		
Opposed			40.0	60.0
Strongly Opposed		50.0	25.0	25.0

x^2= .1969 53 Missing

ELITES CITIZENS

SERIOUSNESS OF HUMAN BIRTH DEFECTS

1=Not at all Serious 9=Extremely Serious

	1	3	7	9
Air Force	25.0			75.0
Scientists				100.0
Utah	20.0	40.0		40.0
Media	33.3		33.3	33.3

x^2= .1195 9 Missing

	1	3	7	9
Tooele		66.7		33.3
Ogden				100.0
SLC	12.5	12.5	50.0	25.0

x^2= .3365 53 Missing

CROP DAMAGE LIKELIHOOD

1=Extremely Unlikely 9=Extremely Likely

	1	3	7	9
In Favor	75.0	25.0		
Don't Know	60.0	40.0		
Opposed	37.5	25.0	12.5	25.0
Strongly Opposed	100.0			

x^2= .5332 7 Missing

	1	3	7	9
In Favor	16.7	50.0	33.3	
Don't Know		42.9	28.6	28.6
Opposed		6.3	75.0	18.8
Strongly Opposed			75.0	25.0

x^2= .0848 32 Missing

	1	3	7	9
Air Force	50.0	50.0		
Scientists	100.0			
Utah	40.0	40.0	20.0	
Media	66.7			33.3

x^2= .0768 7 Missing

	1	3	7	9
Tooele	7.7	30.8	38.5	23.1
Ogden		11.1	88.9	
SLC		18.2	54.5	27.3

x^2= .2973 32 Missing

CROP DAMAGE SERIOUSNESS

1=Not at all Serious 9=Very Serious

ELITES CITIZENS

	1	3	7	9
In Favor	66.7	33.3		
Don't Know	75.0		25.0	
Opposed	33.3		22.2	44.0
Strongly Opposed		100.0		

x^2= .0204 9 Missing

	1	3	7	9
In Favor		20.0	60.0	20.0
Don't Know	16.7		33.3	50.0
Opposed		31.3	25.0	43.8
Strongly Opposed			40.0	60.0

x^2= .3388 33 Missing

	1	3	7	9
Air Force	50.0	25.0		25.0
Scientists	100.0			
Utah	40.0		20.0	40.0
Media	33.3	33.3	33.3	

x^2= .3927 9 Missing

	1	3	7	9
Tooele	7.7	15.4	30.8	46.2
Ogden		12.5	12.5	75.0
SLC		27.3	54.5	18.2

x^2= .2349 33 Missing

LIKELIHOOD OF LONG RANGE EFFECTS

1=Extremely Unlikely   9=Extremely Likely

ELITES

	1	3	7	9
In Favor	50.0	16.7	33.3	
Don't Know		80.0	20.0	
Opposed	37.5	25.0	37.5	
Strongly Opposed			100.0	

x^2= .1139   9 Missing

CITIZENS

	1	3	7	9
In Favor		40.0	60.0	
Don't Know	14.3	14.3	71.4	
Opposed	8.3	8.3	66.7	16.7
Strongly Opposed			57.1	42.9

x^2= .3018   34 Missing

	1	3	7	9
Air Force	37.5	37.5	25.0	
Scientists			100.0	
Utah	20.0	80.0		
Media	33.3		66.7	

x^2= .0515   9 Missing

	1	3	7	9
Tooele		33.3	66.7	
Ogden			70.0	30.0
SLC	16.7	8.3	58.3	16.7

x^2= .1113   34 Missing

SERIOUSNESS OF LONG RANGE EFFECTS

1=Not at all Serious   9=Very Serious

	1	3	7	9
In Favor	100.0			
Don't Know	75.0		25.0	
Opposed	16.7		33.3	50.0
Strongly Opposed			100.0	

x^2= .0120   8 Missing

	1	3	7	9
In Favor	25.0		25.0	50.0
Don't Know		28.6	28.6	42.9
Opposed	7.7	23.1	53.8	15.4
Strongly Opposed			14.3	85.7

x^2= .1338   34 Missing

	1	3	7	9
Air Force	66.7			33.3
Scientists	100.0			
Utah	12.5		37.5	50.0
Media	33.3		66.7	

x^2= .0425   8 Missing

	1	3	7	9
Tooele	11.1	22.2	33.3	33.3
Ogden		22.2	44.4	33.3
SLC	7.7	7.7	30.8	53.8

x^2= .8143   34 Missing